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LIBRARY TRENDS
VOLUME 51, NO. 4, 499–709
SPRING 2003

# *Research Questions for the Twenty-first Century*

Mary Jo Lynch

*Issue Editor*

UNIVERSITY OF ILLINOIS
GRADUATE SCHOOL OF
LIBRARY AND INFORMATION SCIENCE

# LIBRARY TRENDS

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 ISSN 0024-2594.
Postage paid at Champaign, Illinois.



This journal is abstracted or indexed in *Library and Information Science Abstracts, Current Contents, Current Index to Journals in Education, Information Science Abstracts, Library Literature, PAIS,* and *Social Sciences Citation Index.*

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LIBRARY TRENDS

Spring 2003 51(4) 499–709

# *Research Questions for the Twenty-first Century*

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# Research Questions for the Twenty-first Century

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# Introduction

MARY JO LYNCH

THE CONTEXT FOR THIS ISSUE is that analog library service is in a period of dramatic change but is expected to continue well into the twenty-first century expanded by digital library service. Some would argue that the important problems of this era can be solved only through political and technological means. But this issue begins with the assumption that research is essential and asks: What are the most important researchable questions for the next five to ten years and how might they be approached? The definition of research used for this issue is the classic one Jesse H. Shera developed in the July 1964 issue of *Library Trends*:

> Shorn of its mysticism and its methodology, research since (at least) the time of Bacon has been an answering of questions by the accumulation and assimilation of facts which lead to the formulation of generalizations or universals that extend, correct, or verify knowledge.... Described in terms of its sequential acts, research is an intellectual process whereby a problem is perceived, divided into its constituent elements, and analyzed in the light of certain basic assumptions; valid and relevant data are collected; hypotheses (if any) are through objective testing, rejected, amended, or proved. (pp. 142–144)

Each of the authors—people who are well known and respected as researchers—was asked to write an essay that:

- States three to five questions that the author believes could and should be answered through research in the next five to ten years;
- Describes why each question is important now;
- Describes what previous work exists for the researcher to build on;
- Indicates appropriate methodologies.

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 499–502

Authors were told that the questions they chose could come from any area of librarianship and that some overlap between articles was expected.

None of the authors followed the outline exactly, but each produced a thoughtful analysis of research needed in his or her area(s) of special interest. Two of the authors focus on research questions related to libraries serving areas of major national concern: education and health care. Delia Neuman's article on "Research in School Library Media for the Next Decade: Polishing the Diamond" describes what research is needed to advance the practice of school librarianship. Prudence W. Dalrymple's article on "Improving Health Care Through Information: Research Challenges for Health Sciences Librarians" explains how three major problems in health care delivery—quality, information access, and cost—lead to many questions for research by health care professionals, including librarians.

Dalrymple raises the question of how to determine the impact of library service, a topic that is the entire focus of the article by Joan C. Durrance and Karen E. Fisher, "Determining How Libraries and Librarians Help." Durrance and Fisher pose that question for public libraries and strongly recommend context-sensitive qualitative methods as tools to answer it. Also focusing on public libraries is Virginia A. Walter's article on "Public Library Service to Children and Teens: A Research Agenda." Walter poses four key research questions and proposes a series of colloquia to set priorities for research in this area.

Both public and academic libraries are mentioned in "Outcomes Assessment in the Networked Environment: Research Questions, Issues, Considerations, and Moving Forward" by John Carlo Bertot and Charles R. McClure. These authors identify research topics related broadly to outcome assessment in a networked environment and propose a framework to relate that research to traditional evaluation. Both Carol Tenopir and Deanna B. Marcum focus on digital information in the networked environment. In her paper on "Electronic Publishing: Research Issues for Academic Librarians and Users," Tenopir raises three major questions and many related questions in the areas of digital resources and scholarly work, new models for scholarly journals, and librarians as intermediaries. Marcum's paper on "Research Questions for the Digital Era Library" raises similar questions about the use of digital resources, and also raises questions about preservation and about the education of future "librarians."

Christine L. Borgman's article on "The Invisible Library: Paradox of the Global Information Infrastructure" begins with the premise that although libraries are essential to the nation's information infrastructure, they are often invisible to library users. The paper proposes four challenges that arise from this invisibility and suggests research questions arising from each of these challenges. Finally, Michael K. Buckland's "Five Grand Challenges for Library Research" is a short and stimulating essay on five

broad questions that could lead to a deeper understanding of important library phenomena.

When the University of Illinois Graduate School of Library and Information Science (GSLIS) Publications Committee asked this editor to put together an issue on research, she had just submitted a proposal from the American Library Association (ALA) to the Institute of Museum and Library Services (IMLS) for a project that would develop an agenda for research in LIS. Although agenda-setting has not been a productive enterprise in our field in the past, ALA decided to seek funding for an approach different from what had been tried before. The time seemed right since IMLS was seeking direction for the "research and demonstration" portion of the new National Leadership Grants. More important was the fact that a group of leaders in the LIS field had asked ALA to produce a national research agenda where previous efforts had been initiated by federal agencies.

That request for an agenda was one result of the ALA–sponsored Congress on Professional Education (COPE) held in late April 1999 and attended by over 150 persons representing ALA's many units and other interested organizations. The meeting was held because many in the field believed that education for the master's degree in LIS was failing to produce the quantity and quality of graduates needed to deliver the library services needed in the twenty-first century. The COPE produced thirty-six recommendations, six under the heading, "Position Librarianship as the 21st Century Profession," including the one that inspired the IMLS proposal to "develop a problem-based research agenda for the next five years."[1]

The ALA Executive Board charged the Committee on Research and Statistics to develop a plan for producing such an agenda and the committee worked with the Office for Research and Statistics on a proposal to IMLS for funding to support the convening of a carefully selected group of leading researchers and practioners, broadly representative of all sectors of the library community. After training in group process and consensus-building, the group would craft a set of researchable questions based on problems in the field of library and information services (LIS).

The proposal was not successful. But, thinking about the people and issues that might be involved in the agenda-setting effort had planted ideas in my brain that enabled me to conceptualize this issue. It seemed to be an alternative way to produce what the COPE recommended.

The result is a broad and challenging agenda for research in the LIS field—an agenda for work that could enable the LIS field to thrive in this time of dramatic change. Over twenty years ago, Laurence Heilprin spoke at the Annual Conference of the Maryland Library Association regarding the long-term survival of libraries and library schools. Heilprin used ideas from the theory of evolution to frame his presentation and concluded "the library community is a system that appears insufficiently equipped to com-

pete adaptively over the long term." According to Heilprin, two things were necessary for survival over the long term:

> In order to attain control over its own destiny the library community must keep its own members up to date educationally; and beyond this, itself perform the research that alone creates and keeps leadership in its field. (Heilprin, 1980, p. 392)

When he made that speech in 1979, Heilprin gave the library community (libraries and library schools) approximately twenty years to make those changes or it would not survive. Many things have happened in the library community since Heilprin's speech and the community has survived. But no one could argue that building the knowledge base thorough research has been a key factor in that survival. Looking to the future, however, it seems that Heilprin's ideas are even more relevant than they were in 1979. Research will be essential to survival, and these essays suggest what needs to be done.

## NOTE

1. For information about COPE, see http://www.ala.org/congress.

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# Research in School Library Media for the Next Decade: Polishing the Diamond

DELIA NEUMAN

## ABSTRACT

OVER THE NEXT DECADE, research in school library media should focus explicitly on the relationship between library media programs and student learning. Attention to this topic has been a growing theme in the field's research for decades, and a number of factors argue for making it even more central in the coming years: the increasing emphasis on learning and achievement throughout education; the deepening appreciation for the library media specialist's various roles as they relate to this emphasis on learning; the emergence of electronic information resources that highlight the relationship between learning and information use as never before; and the publication of the Information Literacy Skills for Student Learning in *Information Power: Building Partnerships for Learning* (American Association of School Librarians and Association for Educational Communications and Technology [AASL and AECT], 1998). These statements of learning outcomes related to information use tie the school library media field directly to learning as nothing has done before. They provide both a rationale and a conceptual framework for studying students' interactions with information as the kind of authentic learning that is the goal of education in the twenty-first century.

## INTRODUCTION

Picture a simple graphic—the shape of the diamond that you would see in a deck of cards. Now think of this shape as a visual metaphor for the next decade's most important research for the school library media field. One of the following four questions would occupy each of its corners:

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 503–524

1. What are the contributions of library media programs to student achievement?
2. What are the roles of the library media specialist in today's schools?
3. How do students use electronic information resources for learning?
4. What has been the impact of the Information Literacy Skills for Student Learning on library media programs?

At the center of the diamond, illuminating each of the questions and reflecting the light from the answers, is the issue that has always been at the center of education: student learning. For the next decade and beyond, the most important research area for the school library media field involves establishing and documenting the direct relationship of library media programs and library media specialists to that central educational focus. Thus, the four questions draw their luster from the centrality of student learning to the library media field. Answering them in ways that shed light on the relationship of the field to learning will polish the diamond and make it shine more brightly in its own right and sparkle more valuably in the larger field of education.

The questions are grounded in the field's existing body of scholarship at the same time they open new lines of inquiry. The first two have captured researchers' attention for over a generation, but new developments—political as well as technological—have changed the components of the questions and the nature of the answers. The third focuses on a "new" issue but cannot be answered without reference to what we know about learning in general and about learning with information in particular. And the fourth addresses an even newer issue, since there has not yet been enough time to gather enough data to answer it in any meaningful way. Nevertheless, it, too, is grounded in assumptions and priorities the field has held since its inception. And by the end of the coming decade, this facet of the diamond may represent the most important research question in the field.

Other questions will also be important to the field in the next decade—for example, more research like Latrobe and Masters's (2001) study of the implementation of the field's new national guidelines, *Information Power: Building Partnerships for Learning* (AASL and AECT, 1998), would obviously add to our understanding of a variety of issues. With over fifty-six thousand copies of these guidelines sold in twenty-four countries (Robert Hershman, personal communication, March 11, 2002), there is a substantial arena in which to conduct research on the influence of the document, both nationally and internationally. In addition, gathering national statistics about library media programs in the United States in a more regular and comprehensive manner than is currently done would clearly help establish a baseline against which future progress could be measured (A. C. Weeks, personal communication, March 10, 2002). But the four questions noted above are more fine-grained and ultimately more central to the field's es-

sential and enduring concerns. Taken together, they represent library media's diamond-hard core as well as suggesting new facets that will help move forward both the field's research agenda and its effective practice.

## 1. What Are the Contributions of Library Media Programs to Student Achievement?

No one would deny that this is an area of singular importance to the field. While library media professionals "know" the value of their programs' contributions and can point to individual studies as evidence of that value, the field needs more systematic and widespread research evidence in this area to support its claims. Gathering this evidence is important on a professional level as well as a political one. As a professional discipline, library media has an obligation to examine itself and its programs continuously to ensure that they are useful and effective. Politically, until research yields compelling—and widespread—evidence of the nature and extent of library media programs' contributions to measurable student achievement—and until administrators and other decision-makers are convinced to pay attention to that evidence—library media programs' status in the schools will be marginal, even tenuous.

Fortunately, we can point to a large body of work that has been conducted in this area over a period of many years (see, for example, Didier, 1984). More recently, Keith Lance and his colleagues' series of important studies have confirmed a positive relationship between library media programs and student achievement virtually across the United States: the two "Colorado" studies (Lance et al., 1993, 2000b) and the studies in Alaska (Lance et al., 2000), Oregon (Lance et al., 2001), Pennsylvania (Lance et al., 2000a), and Texas (Smith, 2001) that are based upon the "Colorado" methodology. This research has established a strong enough pattern not only to excite the field but also to command the attention of an even wider audience. In fact, shortly after the "second Colorado study" appeared, the newsletter *eSchool News Online* announced in a headline that "Strong media centers boost students' test scores, study says" (Guerard, 2000). The writer clearly knew what was important to the newsletter's readership of educators concerned about technology and learning: the direct relationship of library media programs to measurable outcomes.

Additional replications of studies like these in other states would buttress this pattern to make an even more compelling case for the overall contributions of library media centers to the outcome measures we label "student achievement." Although it is difficult to predict how many such studies are necessary to provide a "critical mass" that will move the importance of the field into the privileged status of conventional wisdom, it's clear that more studies that carry on the "Colorado" tradition would only strengthen library media specialists', the public's, and the educational establishment's perceptions of the field.

Overall student achievement, however, is only the most obvious beginning. The discussion of library media programs' contributions to student achievement has many subthemes that also need further exploration: assessment, equity, collection development, and even flexible access. These subthemes are grounded in issues related to student learning and cover not only the measurement of that learning (a.k.a., "student achievement") but also the strategies and conditions that contribute to it. Moreover, research on the relationship of library media programs to actual student learning—that is, to the process of developing new understandings—is significant enough in and of itself to deserve a priority of its own (see below).

Assessment of student learning is increasingly important in light of national and state priorities on documenting the success (or failure) of the educational enterprise that consumes such a large percentage of public funds. While it is always important to remember that learning and the assessment of that learning are two different things, it is also important to understand that assessment measures provide educators' only avenue for demonstrating to the world at large the worth of their curricular and instructional programs. This is as true for information literacy as it is for math, English, social studies, and science. If learning through the use of information is ever to be taken as seriously by education in general as are these "core subjects," the library media field must develop, test, and implement assessment measures that provide evidence of the widespread success and value of this kind of learning.

Strict, narrow measures of students' learning with information fail to capture the richness of the kind of achievement library media programs support. However, developing and validating objective measures of students' attainment of information skills is an important research task. Such measures, while limited, provide a window into the nature and extent of students' information literacy and, by extension, the contributions of library media programs to that important goal. Once again, an array of tools that provide solid starting places is already in place: writers of curriculum frameworks in states and localities across the nation have developed learning outcomes in library media and information skills and have designed tests to measure students' attainment of those outcomes. Collecting and analyzing student data from a national sample of these tests would begin to provide a broad picture of library media programs' effectiveness. Further, systematic efforts to collect state and local instruments, validate the most promising of them, use the validated tests in a variety of locations, and analyze the resulting data could establish even more widespread and consistent evidence of the contributions of the field to student achievement.

Augmenting objective measures with a variety of other tools that provide "authentic assessments"—for example, rubrics, portfolios, and project-based performance assessments—can provide further evidence of library media programs' unique contributions to student achievement. The con-

cepts and techniques of authentic assessment are not new to either research or practice in the field, and its literature has discussed it for quite some time (see, for example, Grover, 1994; Kuhlthau, 1994; Neuman, 2000; Thomas, 1999). Research that explores and documents the most useful of the options and provides details about their effective implementation would help the field contribute more fully to the discussion of achievement and the role of the library media program in it. Grover, Lakin, and Dickerson's (1997) interdisciplinary model that provides a mechanism for library media specialists to collaborate with teachers in planning and conducting integrated assessments offers a useful framework for thinking about that kind of research. And again, as with objective measures, collecting and analyzing the results of a national sample of individual authentic assessments could further buttress the library media field's claims to value.

Evidence of the field's contributions to equity would also enhance library media programs' abilities to serve students and enhance the library media specialists' image as powerful agents for educational improvement and student achievement. While a great deal has been written in recent years about the "digital divide" and the place of schools in addressing it (see, for example, Solomon, 2002; Swain & Pearson, 2001), little has been written on the topic for the library media field since Neuman's model for fostering equity with technology appeared in 1990. That model has never been tested empirically, and research into its effectiveness would establish (or negate) its validity and suggest additional elements that should be incorporated into library media specialists' efforts in this critical arena. Further research exploring the contributions of library media programs to equitable access and use regarding information technology and information resources could have several positive effects: it could help library media specialists address a topic that is closely allied with the profession's key ethical principles, and it could create a body of evidence that demonstrates library media programs' unique role in the achievement of *all* our students—disabled and disadvantaged as well as "typical."

On the surface, studies related to collection development and flexible access appear less compelling in themselves than many other areas within library media's overall research agenda for the next decade. However, tying these topics to the issue of achievement and learning would ground them in the essential issues of the field. For example, Tallman and van Deusen's (1994) series of reports that detailed the interrelationship of scheduling and other "practical" issues and the implementation of the library media specialist's role in collaborative planning and instruction demonstrated clear ties between such day-to-day matters and the opportunity for the library media specialist to enhance student learning. In the future, research that explores the connections between resources and access to the goal of equity and, in turn, to the goal of learning could demonstrate yet another facet of the library media program's importance to student achieve-

ment. While the "Colorado" studies have begun to investigate these connections, and Bradburn (1999) provides useful tools for documenting some of them, there is far more to be done. Establishing collection development and flexible access as essential components of equitable twenty-first-century learning and achievement could strengthen the library media field both substantively and politically.

## 2. What Are the Roles of the Library Media Specialist in Today's Schools?

Not surprisingly, the recurring theme of "role" continues to need research attention. A concern of researchers and theorists virtually since the beginnings of the field, the question of the various roles of the library media specialist takes on new dimensions each time education shifts its perspective and priorities. The last decade has seen a tremendous shift in virtually every aspect of education—from its underlying pedagogical theories to its organizational structures and its preferred strategies for teaching and learning—and the coming years are likely to witness both a continuation of these changes and the introduction of new emphases and trends. What, then, are the roles of the library media specialist in the first decade of the twenty-first century? What elements of the four roles set forth in *Information Power: Building Partnerships for Learning* (AASL and AECT, 1998) are valued/prominent/evident in today's schools? Ultimately, the question that future research must address is how each role contributes to the central concern of all of today's educators—student learning.

Once again, future research into the roles of the library media specialist can be grounded in discussions that have peppered the field's literature throughout the latter part of the twentieth century. It is important to note, however, that many of these writings have focused on describing particular facets of the library media specialist's overall role or proselytizing for them; the preponderance of authors have stopped short of providing evidence of their value or importance to students and schools. Now, however, the field must replace rationales and calls to action with systematic research related to the nature, uses, and successful implementation of each of the four roles of the library media specialist. The key questions, once again, revolve around the contribution of each role to student learning.

In 1988 *Information Power: Guidelines for School Library Media Programs* (AASL and AECT, 1988) identified three roles for library media specialists—teacher, information specialist, and "instructional consultant." The role of the library media specialist as a teacher of "library skills" or "information skills" had been well accepted for several decades, but the "instructional consultant" role was new and received the most research attention in the 1990s. Even in the decade before *Information Power,* this role had been a topic of intense discussion (see, for example, Craver, 1986, 1990). Studies in ensuing years (see, for example, Pickard, 1993; Putnam, 1996) have gen-

erally concluded that the role is "honored in the breach" rather than in practice: while library media specialists agree with the idea of working with teachers to design and implement instruction, pressures of time, schedule, and teachers' perceptions often preclude the active collaboration the role entails.

The field's current guidelines—*Information Power: Building Partnerships for Learning* (AASL and AECT, 1998)—retitled the instructional consultant role, calling it "instructional partner"; kept two other roles from the 1988 guidelines ("teacher" and "information specialist"); and added a fourth role: "program administrator." Clearly, research in the coming decade should focus on the nature and impact of each of these roles in contemporary education: What does the library media specialist, as teacher and instructional partner, contribute to student learning in a school that is moving to a constructivist philosophy or has one in place? In a political climate that identifies (and funds) reading as a preeminent student goal? How does the library media specialist add value, as an information specialist, in a technology-rich environment that undergirds not only the school but the immediate communities and the larger society in which today's students and their families live? How does the new prominence assigned to the library media specialist's role in program administration affect principals' and teachers' perceptions of the library media specialist as a member of the instructional team? How does it affect the library media specialist's actual ability to affect curriculum, instruction, and—ultimately—student learning? All these questions and a host of similar ones need research-based answers if the field is to move forward in a productive and systematic fashion.

At present, of course, such answers are sparse: the five years since the publication of the new guidelines have not given library media specialists enough time to implement each of the roles fully, let alone provided researchers enough time to study them extensively. McCracken (2001) is the first to take up this line of research in recent years with her survey of library media specialists' perceptions of the importance and practicability of each of their roles, both those identified in 1988 and the new titles promulgated in 1998. In addition, several studies that appeared even before 1998 suggest other promising approaches for examining the nature and impact of the newly stipulated roles. For example, Bishop and Blazek's (1994) qualitative study of library media specialists' activities in a literature-based reading program in Florida confirmed that the library media specialist can have an important impact in such programs and provided insightful details about the relationship of the roles of teacher, information specialist, and instructional consultant in that impact. Van Deusen's (1996) case study of one library media specialist's instructional consulting role in a new elementary school identified eleven separate tasks the library media specialist played in instructional-team meetings and offered suggestions for both practice and preparation that would facilitate the completion of those tasks.

Van Deusen's conclusion that the library media specialist is an "insider/outsider" member of the teaching team provides the kind of insight that has strong potential for helping the field understand—and build upon—the nature and impact of this particular role. Future studies that plumb the details of all four of the library media specialist's roles can provide a knowledge base that clearly links the roles to student learning and thereby promotes the substantive and political welfare of the field.

## 3. How Do Students Use Electronic Information Resources for Learning?

Student learning is at the heart of the school library media field, and the question of how students learn with electronic information sources is one of the field's key research questions for the coming decade. While print and audiovisual resources are sure to remain important tools for learning in classrooms and library media centers, it is the interactive resources that hold the greatest promise for enabling students to engage meaningfully with information and to use it as the basis for developing sophisticated understandings of the world in which they live. Learning with information is the authentic learning that is sought by all educators today, and fostering learning with information is the library media program's central contribution to student learning and achievement. Research that explores students' learning with the emerging—and still not fully understood—electronic resources that will provide the richest venue for their learning throughout their lives should be a central focus for the field.

As with the other questions under consideration here, the basis for this facet of the next decade's research can be found in the "traditional" library media literature. Over thirty years ago, Joyce and Joyce (1970) became the first researchers in the field to explore the direct relationship of information use to learning. More recently, a host of other library media researchers have mined this territory. In the 1980s and 1990s, for example, the resource-based learning movement spawned considerable interest in the use of information resources as the basis for student-centered learning (see, for example, Bleakley & Carrigan, 1994; Eisenberg & Small, 1995; Meyer & Newton, 1992; Ray, 1994). During this period, a variety of researchers not directly associated with the movement also contributed to the burgeoning literature on information use and learning: Garland (1995), McGregor (1994a, 1994b), Moore and St. George (1991), Pitts (1994), and Stripling (1995) have all added to the literature on this topic. Perhaps as an indication of the importance of these developing ideas, the entire inaugural issue of the journal *School Libraries Worldwide* (Oberg, 1995) was devoted to learning with information.

More recent literature continues to address this issue, and a few examples suggest the breadth of current research and theory on the topic: Carey (1998) has linked information literacy to learning theory in general and

to higher-order thinking skills in particular; Kuhlthau (1999) has chronicled the views of participants in the Dewitt-Wallace Reader's Digest Fund's Library Power Project on the relationship of the library media center to learning; McGregor (1998) has examined the relationship between learning and the everyday details of the research process as understood by students; and Todd has looked both at the impact on content learning of integrated information-skills instruction (1997) and at the way information use changes the cognitive models of adolescent girls (1999). Donham, Bishop, Kuhlthau, and Oberg (2001) have compiled learning-related findings from the Library Power Project into a useful summary document that suggests important points of departure for further research on learning with information, while Thomas (1999) has presented a range of work concerning students' effective use of ideas and information that offers a comprehensive overview of findings and issues that provides solid grounding for future research. Clearly, there is no dearth of research and theory in the field that can feed into a comprehensive framework to underpin studies of how learning plays out in electronic environments.

Another important source for developing such a framework is provided by the major information-seeking models created by scholars in the field, all of which include steps that lend themselves to a "learning" focus. The Stripling and Pitts REACTS model (1988), for example, called for students to "draw their own conclusions," create personal perspectives from information, and "create original solutions"—all components of authentic learning. Kuhlthau (1993) entitled her book *Seeking Meaning,* connecting the search for information to the kind of personalized construction of meaning (i.e., learning) that is the optimal result of such a search. Eisenberg and Berkowitz (1990) entitled their book *Information Problem Solving,* relating their Big Six Skills directly to one of the forms of higher-order learning most prized in schools today. Joyce and Tallman's I-Search model (1997) includes "reflecting" as a key component in students' pursuit of information based on their personal interests, while Pappas's (1997) "Pathways to Knowledge" emphasizes interpretation of information as a key to moving from the gathering of information to the attainment of knowledge. Each of these models, then, provides implicit theoretical support for a research focus on learning with electronic information resources. Making that focus explicit is a logical next step.

There is also a great deal of research related to information seeking in electronic environments that can be merged with the literature on learning with information to guide the researcher who wishes to examine learning in the electronic realm. Many studies have investigated students' searching and retrieval behaviors with electronic sources, noting in particular the problems young people encounter along the way to finding and recording appropriate information (e.g., Bilal, 2000, 2001; Fidel, 1999; Hirsch, 1997, 1999; Oliver & Perzylo, 1994; Perzylo & Oliver, 1992; Schacter et al., 1998;

Small & Ferreira, 1994; Solomon, 1993). Some researchers have approached the issue of learning in electronic environments by couching their discussions within issues related to learning or by drawing implications for learning from their findings (e.g., Kafai & Bates, 1997; Kuhlthau, 1997; Liebscher & Marchionini, 1988; Marchionini, 1989; Marchionini & Teague, 1987; Solomon, 1994). Others (e.g., Aversa & Mancall, 1986; Callison & Daniels, 1988; Crane & Markowitz, 1994; Mancall, 1984; Neuman, 1993, 1995, 1997) have contributed to a stream of research and scholarship that has addressed the usefulness of databases and other tools as venues for helping students develop skills in critical thinking and in mastering those "higher-order thinking skills involved in designing, conducting, and interpreting research" (Neuman, 1995, p. 291).

It is important to note, however, that a specific focus on using electronic information resources for *learning* (rather than only for information retrieval or for fostering skills directly related to that retrieval) is relatively new for the library media field. Such resources are themselves still relatively new, and discussions of learning with them have received close and direct research attention in the library media area for less than a decade. For example, two important publications—Kuhlthau's edited volume entitled *The Virtual School Library* (1996) and a special issue of *Library Trends* devoted to "Children and the Digital Library" (Jacobson, 1997)—focused primarily on describing and explaining the new information environments for children that were evolving in school and public libraries and included relatively few papers related specifically to learning in those environments. Now that the field has a better understanding of the environments themselves, the time has come for a wide range of studies that explicitly examine the link between student learning and the electronic resources that have become a staple of library media programs.

To date, Large and his colleagues' series of studies offer the field's most intensive and extensive look at information use and learning in electronic environments (Large et al., 1994a, 1994b, 1995, 1996, 1998, 2000). Working with a variety of other researchers, Large has examined students' interactions with a variety of electronic resources, studying their information-processing strategies from the initiation of their search strategies, through their navigation of the resources, to their extraction of information for classroom assignments. Over the years, this group has provided thoughtful and insightful commentary on the possibilities and constraints inherent in using these tools for learning. Now, others are entering the discussion: Neuman (2001, in press [a]) has argued that synthesizing—the process of creating a personal conceptual structure from information elements found in discrete electronic resources—is the key to learning with the World Wide Web, while Chung (2002) has demonstrated a connection between information-seeking in electronic resources and learning at each of the six levels in the recent revision of Bloom's taxonomy (Anderson & Krathwohl, 2001).

In the next decade and beyond, researchers must perform the challenging intellectual task of integrating the insights gleaned from the rich but somewhat disparate research areas noted above into a comprehensive conceptual framework that can guide systematic research on the relationship between learning and information seeking in electronic environments. And, just as the convergence of decades of research into children's information-seeking and use can undergird a conceptual framework that moves to a direct and explicit focus on this topic, other theoretical and research traditions, too, must be incorporated into that framework to make it robust and comprehensive. In particular, instructional systems design has contributed extensively to discussions of information environments as learning venues and offers strong promise for helping library media researchers gain a comprehensive understanding of the interactions among students, information, and learning.

Robert Kozma's seminal 1991 article on learning with media provides theoretical guidance for much of the research on learning in the information-rich multimedia environment of the World Wide Web that would be of value to the library media field. Other instructional-design researchers, especially Michael Hannafin and his colleagues at the University of Georgia, have developed a strong research strand in this area. (See, for example, Hannafin, 1992; Hannafin et al., 1994, 1999; Hill, 1999; Hill & Hannafin, 2001; Oliver & Hannafin, 2001; and Park & Hannafin, 1993.) Others, too—like Edelson et al. (1999), Goodrum, Dorsey, and Schwen (1993), Miodus-er et al. (2000), and Roschelle et al. (2000)—offer relevant insights couched within an instructional-design framework. In one of the more recent contributions from this field, Jonassen, Peck, and Wilson (1999), explaining how technologies can foster learning, describe five roles that technologies can play "as engagers and facilitators of thinking and knowledge construction." In one of these roles, technologies serve as "information vehicles for exploring knowledge to support learning-by-constructing" because they provide opportunities "for accessing information [and] for comparing perspectives, beliefs, and world views" (p. 13). Clearly, Jonassen et al. are describing the electronic information resources that concern the library media field. Thinking of these not only as venues for information seeking but also as learning tools would enrich any researcher's conceptual framework for studying the relationship of library media programs to learning.

In fact, Jonassen and other theorists and researchers from instructional systems design can help the library media field focus on authentic learning with information. By expanding library media researchers' understanding of the learning potential of electronic information resources, instructional design can help them frame and answer questions about how students represent knowledge in their own minds at various stages of the information-seeking process, how they extract information from both textual and visual presentations and construct personal meaning from it, how

they integrate various kinds of information into their own understandings, how they move from one level of understanding to another, and how information use supports the growth and development of students' changing conceptual structures as they move forward along the novice-to-expert continuum. Finding answers to these difficult and complex questions could not only enrich research and practice within the library media field, it could help to strengthen the link between information use and learning that is central to the field's mission and to its stature within education as a whole. By reinforcing that link with research-based evidence of library media's contributions to students' learning with electronic resources, researchers in the field would be making an important contribution (Neuman, in press [b]).

## 4. What Has Been the Impact of the Information Literacy Standards for Student Learning on Library Media Programs?

The Information Literacy Standards for Student Learning (ILSSL) are the cornerstone and most important contribution of *Information Power: Building Partnerships for Learning* (AASL and AECT, 1998), the latest set of guidelines for the school library media field. Validated by a national Delphi study (Marcoux, 1999), the nine Standards and their twenty-nine associated indicators are direct statements of learning outcomes—the first ever to be endorsed by the two national associations that represent the library media field. For researchers, the ILSSL suggest a virtually unlimited number of topics to investigate related to various aspects of their general and specific impact on library media programs. Now that they have been available for almost five years, it is time to begin that research in earnest. By the end of the decade, its results should provide a wealth of theoretical and practical insights for the field.

At one level, answering the question about the impact of the ILSSL on library media programs is fairly straightforward. States and localities began adapting them to meet their own curricular and instructional needs even before *Information Power* was published, so tracing the Standards' evolution into state, district, and local documents would be a comparatively straightforward task. It's a task that should be done in order 1) to provide an understanding of the extent to which the field has adopted these "learning statements" in both theory and practice, and 2) to delineate the ways in which these national statements have been modified and implemented to meet local needs. A national collection of this "demographic" research would not only document the reach of the Standards into library media programs but would also provide a rich set of related statements of learning outcomes that individual schools could use in further developing and refining their library media programs and services.

Additional studies should address whether and how well the ILSSL function as tools for collaborative planning and teaching—one of their

primary purposes, according to *Information Power:* "The [ILSSL] provide the basis for the library media specialist's role in collaborative planning and curriculum development. . . . They strongly support the school library media specialist's leadership role in analyzing learning needs, identifying instructional strategies and resources, and evaluating student achievement" (AASL and AECT, 1998, p. 63). Case studies of the nature, process, and effects of using the ILSSL in planning and conducting collaborative instruction can lead to insights about how well the Standards support the library media specialist's role as an instructional partner—historically one of the most difficult of his/her roles to implement. Results of such studies could provide both theoretical and practical guidance for the field in helping to establish library media specialists—both substantively and in their colleagues' perceptions—as central players on schools' learning teams.

Research into the overall impact of the ILSSL on library media programs must involve studies that look directly at the impact of these statements on the learning that such programs are designed to foster. In fact, the singular importance of the Standards is that they tie the field directly to learning as nothing has done before: according to *Information Power,* the ILSSL "are the foundation for the school library media program. . . . They demonstrate clearly that information skills are integral to learning and teaching and should be linked to the curriculum in every subject area and grade level" (AASL and AECT, 1998, pp. 61–62). For researchers, the ILSSL both reflect decades of previous research on the relationship of the field to learning and provide a framework for designing further research in this critical area. Extensive studies of the details of students' interactions with information resources as they work to meet the Standards and indicators can enable researchers to tackle questions about the nature, processes, and effects of learning with information. Collecting the results of such studies across the nation can contribute significant color and texture to a broad picture of the overall effectiveness of library media programs.

The Standards and indicators themselves provide a convenient yet comprehensive framework for such studies. Broad statements of learning outcomes, the Standards are similar to instructional goals that describe long-term results that cannot be directly assessed—for example, "The student who is information literate evaluates information critically and competently" (Standard 2, p. 14); "The student who is an independent learner is information literate and appreciates literature and other creative expressions of information" (Standard 5, p. 26); and "The student who contributes positively to the learning community and to society is information literate and participates effectively in groups to pursue and generate information" (Standard 9, p. 39). The indicators are more narrowly focused, describing specific outcomes that are similar to objectives that can be observed and even measured to provide an assessment of students' mastery of the learning they describe—for example, "Seeks information from diverse sources, contexts,

disciplines, and cultures" (Standard 7, Indicator 1, p. 33). A teacher or library media specialist could easily devise a way to evaluate whether his or her students seek information broadly, perhaps simply by checking bibliographies in students' papers to determine the extent of their searching.

Some of the indicators describe varieties of learning that are directly related to the information-seeking process—for example, "Develops and uses successful strategies for locating information" (Standard 1, Indicator 5, p. 11) and "Assesses the quality of the process and products of personal information seeking" (Standard 6, Indicator 1, p. 29). Others go beyond consideration of the learning required to seek and find information to describe varieties of cognitive processing that are at the heart of learning itself—for example, "Integrates new information into one's own knowledge" (Standard 3, Indicator 2, p. 19) and "Applies information in critical thinking and problem solving" (Standard 3, Indicator 3, p. 21). Still others describe some of the most subtle kinds and highest levels of learning sought in schools today—for example, "Derives meaning from information presented creatively in a variety of formats" (Standard 5, Indicator 2, p. 26); "Collaborates with others, both in person and through technologies, to design, develop, and evaluate information products and solutions" (Standard 9, Indicator 4, p. 41); and "Devises strategies for revising, improving, and updating self-generated knowledge" (Standard 6, Indicator 2, p. 30). Taken together, the Standards and indicators describe the full range of learning outcomes, from basic to sophisticated, that constitute authentic learning in the information age. They provide a ready framework for researchers to use in investigating the direct contributions of the ILSSL to student learning and achievement (Neuman, in press [b]).

As with the questions discussed in earlier sections of this paper, this one is grounded in a history of related research that can inform the next stages of the field's research agenda. In fact, much of the specific research discussed in those earlier sections can also be applied here: studies of information seeking and of learning with both traditional and emerging information resources, for example, can obviously contribute to a conceptual framework for research on ways in which the ILSSL contribute to learning. Other writing in the field can also be brought to bear: for example, the wide range of pieces on information literacy obviously provide important theoretical grounding for research related to the Standards and their utility in learning. Breivik and Senn (1994) are perhaps the best-known proponents of information literacy as a key element in twenty-first century education, but others have addressed the topic as well. Among these are Neuman (1997), who proposed information literacy as the framework for addressing issues related to learning in the digital library; Carey (1998), who argued for the importance of ensuring higher-order outcomes in information literacy; and Fitzgerald (1999), who has already raised some of the key

questions related to information literacy and the Standards, particularly the challenges involved in students' abilities to evaluate information.

In many ways the question of the impact of the Information Literacy Skills for Student Learning provides the touchstone for much of the critical work that should be done in the library media field in the coming decade. In fact, the question integrates and provides a context and theoretical structure for a research agenda encompassing all three of the other questions set out at the beginning of this paper as the most important for the field: any studies related to the impact of the ILSSL would inevitably address student learning with electronic resources, the roles of the library media specialist in fostering learning, and the nature and extent of the student achievement that might be related to library media programs. Important not only in and of itself, answering the question of the impact of the ILSSL is the key to understanding the functions and importance of library media programs in the first decade of the twenty-first century: "As the primary vehicle for linking library media programs and library media specialists with learning, [the ILSSL] are the key to implementing the vision that underlies *Information Power: Building Partnerships for Learning*" (AASL and AECT, 1998, pp. 49–50).

## Conclusion

The question of student learning is at the crux of all the most significant research to be done in school library media in the next decade. The four research areas described above—the relationship of library media programs to student achievement, the roles of today's library media specialist, students' use of electronic resources for learning, and the impact of the Information Literacy Standards for Student Learning—form the corners of a diamond whose core is also the core of education: student learning. Establishing and documenting the direct relationship of library media programs and library media specialists to learning will show the centrality of student learning to the library media field, polishing the diamond and increasing the value of library media programs both in their own right and within the larger field of education.

At the dawn of the twenty-first century, student achievement is no less important to the library media field than to any other discipline. While research on the overall relationship of library media programs and library/information skills to achievement has been conducted for years, recent work has been especially successful in establishing a strong connection. It is important to the field that this research stream continue and that subthemes related to this general topic also be explored. Research into the uses and varieties of assessment that best serve library media programs' unique roles and contributions is one such subtheme; investigations of library media programs' role in ensuring equity is another. Studies that explore the rela-

tionship of collection development and flexible access to equity and ultimately to learning and achievement could also strengthen the field both substantively and politically.

Future research must also address the question of how the various roles of today's library media specialist contribute to student learning and achievement. Each of the four roles described in *Information Power: Building Partnerships for Learning* (AASL and AECT, 1998)—teacher, instructional partner, information specialist, and program administrator—has been deeply affected by the changes that have swept through society and education in the last two decades. What, then, are the most important duties and the most significant expectations of the library media specialist in the new century's culture of change? Which elements of his/her roles and which combinations of those elements are most widely practiced and most widely valued in the schools of the early twenty-first century? Ultimately, research related to the library media specialist's roles should address the key question of how each role contributes to the central concern of all today's educators—student learning.

Learning with information is the library media program's central contribution to student learning, and research on learning with the electronic resources that are emerging as essential sources of information should be a key facet of library media research in the coming decade. Studies by library media researchers that build on a comprehensive conceptual framework that combines insights from a variety of traditions in theory and research—studies of the general connection between information and learning, research on children's information seeking and use, exploration of the "learning" components of our information-search models for children, and insights into information environments as understood by theorists and researchers in instructional systems design—can lead to a deeper understanding of the relationship of information and learning and a greater appreciation of the library media specialist's role in guiding students in effective engagement with information as the basis for developing sophisticated understandings of the world and their place within it. Such a contribution from the library media field would not only advance its own theory and practice but would also lead the way to a greater understanding of learning with information for the field of education as a whole.

The Information Literacy Standards for Student Learning, published as the key element in *Information Power: Building Partnerships for Learning* (AASL and AECT, 1998), provide a ready mechanism for linking the library media specialist to learning and for studying that linkage systematically and comprehensively. While the ILSSL have received extensive attention since their appearance in the summer of 1998, much of the attention—understandably—has been devoted to practice as the field learned about and tried to implement the new national guidelines. Now that the ILSSL have been available for almost five years, it is time for researchers to begin to study

whether and how well they do, in fact, support student learning and achievement. One research strand should include studies of the overall contributions of the ILSSL to library media programs, both locally and broadly and both substantively and in the perceptions of other educators. Another should focus on the usefulness of the ILSSL as catalysts for collaboration with teachers and as tools for guiding curriculum and instructional development. Still another should address the details of students' cognitive and affective processes as they engage with the steps in information literacy and learn to use information to formulate increasingly mature and complex mental models. By the end of the decade, a range of such studies could further delineate the range of kinds of learning that are possible with information and provide strong evidence of the direct relationship that links the ILSSL and library media programs to that learning.

All four of these questions interweave traditional and emerging issues in the library media field, and all four are grounded in the scholarship and research of the field over the past thirty years or more. What has changed most significantly for the field in recent years stems from an increasing focus throughout education on learning rather than on teaching and on students' active construction of their own meaningful knowledge rather than on teachers' imparting ideas that students process more or less passively. This monumental shift in perspective has led in turn to a deeper understanding of learning as a process rather than only a product: learning has been reconceptualized from the behaviorists' notion of learning as a change in behavior or the ability to behave to the cognitivists' definition of learning as "the development of new knowledge, skills, or attitudes as an individual interacts with information and the environment" (Heinich et al., 2002, p. 6).

This focus on the process of learning—and especially on learning through encounters with information—has long been a thread in library media research, theory, and practice. Now, it has opened new opportunities for the library media field and has led to the field's increasing awareness of the importance of library media programs and library media specialists in fostering student learning. As *Information Power* notes, "Core elements in both learning and information theory . . . converge to suggest that developing expertise in accessing, evaluating, and using information is in fact the authentic learning that modern education seeks to promote" (AASL and AECT, 1998, p. 2). This new understanding has reshaped the field's view of itself and provided an impetus for research that both clarifies that view and instantiates it within the broader context of education.

Therefore, it seems clear that research that defines and explains the relationship of the field to student learning and achievement in a modern, information-rich culture is the most important research to be undertaken by the field's researchers in the coming decade. Learning is at the heart of the library media field and at the center of the "research diamond" proposed at the beginning of this paper. Research that illuminates how the

various facets of library media programs foster learning will add luster to the field, bringing out for the field itself and for the broader educational community the "many bright colors" praised in the old Spanish folk song "De Colores." As the chorus to that lilting and optimistic tune notes, "the diamond will sparkle when brought to the light."

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# Improving Health Care through Information: Research Challenges for Health Sciences Librarians

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## ABSTRACT

RESEARCH QUESTIONS IN HEALTH SCIENCES LIBRARIES are influenced by the health care environment. Three fundamental problems underlie most research in health sciences librarianship: determining what therapies are effective and of good quality, delivering information when and where it is needed, and in forms that will increase its use. Adapting to sweeping changes in all kinds of libraries is made more complex because of equally challenging shifts in medical practice and consumer health. Developments in health information research will be advanced through collaboration across disciplines and between organizations.

## INTRODUCTION

While many of the problems and issues facing health sciences libraries are held in common with other libraries, problems and issues specific to health sciences libraries are driven by the agenda of the health sciences in general. In health sciences, as perhaps in no other major library sector, the strength and importance of the national library, of grant funding, and of the community of users themselves, drive the direction of research. While health sciences libraries certainly face issues of collection preservation and management, digital library system design, effective organization and staffing, and public relations, health sciences libraries have unique challenges and opportunities. Health sciences libraries operate within the environment of health care delivery and are therefore affected by the trends and factors that characterize this environment. Quality health care—accessible to all who need it, at a fair price—is the primary driver in the health care

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 525–540

environment. Fundamental to virtually every issue in health sciences librarianship is one or more of the following problems:

- Determining what therapies are effective and of good quality;
- Delivering information when and where it is needed in forms that will increase use;
- Developing an effective economic model.

This situation is not new. The Medical Library Association (MLA) founded the Library Research Section in June 1982; one of its stated purposes was to serve as an action group for the advancement of library-related research. This purpose was later expanded in 1996 when the name was changed to the "Research Section" to reflect interest in general research, not just that of libraries.[1] In the 1990s, MLA undertook the development of a policy statement on research. The opening paragraph of the research policy reflects these central concerns:

> Society is concerned about access to high-quality health care at reasonable cost. Increasing numbers of health care leaders recognize the importance of information to excellent, affordable health care. Clinical decisions should be based on the scientific evidence traditionally recorded in the health sciences literature. The development and use of evidence-based practice guidelines demand a sophisticated analysis of the literature, creative ways of delivering information to practitioners at the point of care, and an understanding of the effect of information on practice patterns and costs. There is a growing need for computer-based patient record systems that can generate new scientific knowledge as a by-product of current care. (Medical Library Association, 1995, p. 4)

This statement reflects the influence of three external events that have resulted in sweeping changes affecting the role of health sciences libraries. As with all libraries, the advent of the Internet irreversibly altered practice, but in health libraries especially, the availability of free, public access to MEDLINE signaled a major shift in emphasis by the National Library of Medicine (NLM) toward providing health information to the public. Second, the report issued by the American Association of Medical Colleges (AAMC), which introduced the concept of the Integrated Academic Information Management System (IAIMS) in 1982, has continued to alter the landscape of academic health information centers, just as the release of the 1994 Joint Commission's *Standards for Accreditation of Health Care Organizations* affected hospital libraries.[2] Third, the rise of the evidence-based medicine movement has affected the role of information (data and knowledge) in the practice of medicine.

Within the practice of librarianship, the changes have been no less dramatic. Libraries as organizations have traditionally been concerned with the acquisition, organization, and dissemination aspects of the information transfer cycle. With the advent of digital information where "everyone is a

publisher," librarians have increasingly become concerned with the creation of information. And, as they become collaborators in the design of information systems, they increasingly become involved with the *use* of information. These changes are especially apparent in the health sector, where health sciences librarians are beginning to recognize that "collections of data aggregated from individual health records, like the clinical data warehouse or the population health data set, can be viewed as part of the larger digital library needed to support biomedical research, education, and informed health care decisions" (Humphreys, 2000, p. 446).

In addition to, or perhaps because of, the magnitude of the changes and the importance of medicine, the field of biomedical information now includes a variety of potential collaborators, all of whom claim legitimate interest in the digital health library. As Betsy Humphreys (2000), associate director of the National Library of Medicine states, viewing health data as part of the digital library "not only opens up new funding opportunities but may also encourage fruitful multidisciplinary cooperation on problems common to knowledge based information and aggregated health data, including permanent retention of electronic information or the need to implement variable user access privileges" (p. 446).

The breadth and complexity of the research problems that this statement raises extend beyond the ability of a single researcher, or even a single sector of the health care environment. Collaboration across sectors is necessary, and substantial funding is essential. As health sciences librarians position themselves as players within this larger environment, they open opportunities for participation in and support from, the National Institutes of Health (NIH) through the NLM. At the same time, librarians must either compete or collaborate to ensure that they remain players in this domain and that the values associated with librarianship continue to be acknowledged in the development of research agendas.

This represents a major change from the early origins of the field. For most of the past century, academic medical libraries functioned much as academic libraries everywhere, working with faculty and students to support the medical school curriculum. In the clinical arena, hospital libraries served the information needs of physicians and, more recently, those of nurses, administrators, and allied health personnel. Increasingly, librarians compete with medical informaticians, basic scientists, health service statisticians, and clinicians for ownership of problems and approaches. A benefit to this competition is that the problems and research in this area are understood and shared to some extent by others and that a broader array of resources, both financial and methodological, can be brought to bear on problems. The multidisciplinary approach also can determine which research questions will be pursued.

Health sciences libraries form an integral part of the fabric of medical informatics, and librarians form an integral part of the research team. Thus,

the research problems that characterize this field are not limited to libraries *per se,* but are driven by the role of libraries and librarians in resolving issues that extend beyond formal library organizations and that certainly include, and even center on, problems of digital libraries and knowledge-based information and documents. Librarians have traditionally been concerned with knowledge-based information, and this will certainly continue to be the case in the future. However, problems of knowledge-based data can no longer exist in isolation from clinical data in order to resolve the problems facing health information systems in society. Because knowledge-based information is one component of "health information," librarians must work together with other health professionals to solve these research problems. The remainder of this article will focus on how these three fundamental factors—quality, delivery, and economics—form the central focus of research in health sciences librarianship. It will conclude by placing these health-related issues against the backdrop shared by all types of libraries, such as the evolution of digital libraries and the tension between ensuring universal access to information while protecting individual privacy and intellectual property.

## I. Quality: Determining What Therapies Are Effective and of Good Quality

Delivering quality health care to patients is central to the practice of medicine. To determine which therapies are most effective, to select which procedures "do no harm," and to manage one's practice in a cost-effective manner requires lifelong learning and continual updating. Yet, the vast size and rapid growth of the biomedical literature is an acknowledged impediment to maintaining currency in the field. According to some estimates, 2 million articles on medical issues are published annually worldwide (Balas & Boren, 2000, p. 65). To read everything of potential biomedical importance, it has been estimated that physicians would have to peruse 6,000 articles per day, and a general physician who just wants to keep up with the literature relevant to her practice would face the task of examining nineteen articles a day every single day of the year! (Balas & Boren, p. 66). In their role as providers of knowledge-based information to clinicians, medical librarians have traditionally culled the most relevant and precise information in response to a query. With the growth of end-user access to databases, medical librarians support clinicians and other health personnel in developing information management skills so that they can retrieve appropriate information to meet their information needs independently. In the last twenty years, however, medical librarians have extended these roles to include selecting the *best information* to fill the need. This practice—selecting the best articles, not simply those that are most relevant—is called quality filtering. It was first developed at McMaster University; McKibbon (1998) and others have written extensively on the concept and have been the pri-

mary developers of various techniques to ensure quality retrieval. Some librarians have taken quality filtering to its next logical step—participation in evidence-based medicine initiatives.

Evidence-based medicine, or more broadly referred to as evidence-based practice, is defined as the management of individual patients through individual clinical expertise integrated with the conscientious and judicious use of current best evidence from clinical research (Sackett, 1996). Originating in Great Britain with the Cochrane Collection, evidence-based medicine seeks to analyze research and to identify those studies that meet stringent guidelines of quality. The findings in these studies constitute the evidence upon which clinical guidelines for practice are based. The process requires extensive searches of the biomedical literature to identify the body of relevant studies. A team of experts, sometimes including librarians, examines the studies to determine whether they meet stringent criteria set up for scientifically valid research. The findings that meet this "gold standard" are then further analyzed and the results compiled into guidelines for clinical practice. Thus, the "evidence" referred to in "evidence-based medicine" is the scientific evidence that underlies current standards of practice. Evidence-based practice (EBP), then, is practice based on evidence that is found to be empirically sound and verifiable; it may be modified where necessary by the clinical judgment of the practitioner, based on his or her observation and experience. The role of librarians in this enterprise has been studied and advocated by Scherrer and Dorsch (1999), among others.

This shift, from relevance to utility/effectiveness, requires that librarians be capable of conducting additional analysis of the literature. For many years, the indexers at the NLM have tagged articles to indicate the type of research reported. The number of these tags is continually expanded so that articles that meet the standards of a randomized clinical trial (RCT), for example, are identified and searches can be limited to only those studies that meet the RCT "gold standard." Since the body of literature retrieved may be larger than an individual has time to read and absorb and little work has been done to determine to what extent these limits are actually invoked, we know little about the actual effectiveness of this indexing enhancement.

While librarians are familiar with the traditional indicators of quality in the literature, such as peer review and citation patterns, identifying and selecting literature that is of greatest utility or effectiveness requires an additional set of criteria. Cranfield's early studies on precision and recall were among the first in a body of research literature that focuses on information retrieval (IR). The IR research stream provides a basis for understanding the effectiveness of indexing filters, but additional research is needed to fully understand how to design systems for effective and efficient quality filtering that can be applied to evidence-based practice. The results of information-retrieval studies should be diffused to those who develop information delivery systems in order to ensure that any technological so-

lutions designed to meet clinical information needs effectively locate the appropriate literature.

In addition to examining the process of retrieving information, the literature itself presents an important research area. According to the report of a recent symposium sponsored by the American Medical Informatics Association (AMIA), medical literature is still beset with problems of research design; furthermore, even literature of high quality remains inaccessible to the practitioner (Sim et al., 2001). What is the role of librarians monitoring and encouraging quality medical literature, particularly information aimed at and available to consumers? The work of Ann Weller on the process of editorial peer review and its effect on quality should be continued to advance understanding of the way medical knowledge is created, controlled, and disseminated (Weller, 1987, 1990, 2002). Editors, publishers, peer reviewers, database developers and distributors, and indexers all work to ensure that quality literature is published, indexed, disseminated, and retrieved. How should their performance be evaluated? How might electronic publishing affect these practices? How can the "best" literature be assured of dissemination? How can mediocre and even erroneous literature be identified as such? And, how can these "controls or filters" be implemented without threatening the free flow of information?

Librarians continue to demonstrate their key role in the information transfer cycle by advocating that information be made available at a fair price. Librarians at the NLM also are responsible for the quality of the indexing, the selection of the journals to be indexed, the monitoring and testing of the interfaces and search engines that retrieve the literature, and even for the peer review of the literature. They also participate in the teams that select the articles for clinical guidelines, and identify the gold-standard RCT literature. Finally, they can be participants in the teams that identify and evaluate the literature that is brought to bear in the embedded, knowledge-based systems. Improved health care demands that practitioners keep up with the latest techniques and have the ability to evaluate the literature so as to know when to incorporate findings into practice.

It is almost a truism that the format and standards for research publications have remained stable for decades, despite the reality that most clinicians find research hard to read and understand, and even more difficult to apply the findings to practice (Balas & Boren, 2000). There is a body of literature on improving the clarity of abstracts, as well as their readability, but much of this research has been conducted outside of library and information science (Hartley, 2000) and focused primarily on the print literature. The effects of structured abstracts and other access mechanisms on the use of the literature and its effect on actual clinical practice, particularly as more and more literature is available electronically, has not been fully investigated. Standards for structured abstracts and their relationship to the indexing that is applied to them and the search engines that retrieve

them are all important research areas in which librarians have both the interest and expertise to make valuable contributions.

## II. Delivering Information When and Where Needed in Forms That Increase Use

Quality control of the literature is essential and the next step is ensuring that those in practice heed the findings of that literature. In short, it is the problem of connecting knowledge with practice. It has been recognized for decades that the diffusion of innovation is a remarkably slow and inefficient process; in medicine, it takes an average of seventeen years to implement clinical research results in daily practice (Balas & Boren, 2000, p. 66). Underlying the concern for timely delivery of valuable clinical knowledge is the prevention of health care errors. The Institute of Medicine's (1999) recent study revealing the extent to which medical errors are costing human lives and precious dollars has spurred greater interest in developing approaches to reduce errors a well as to improve clinical practice. Reducing error includes both errors of omission and commission, inappropriate therapy selection, and incorrect or incomplete diagnoses, as well as "mistakes" such as wrong dosages, flawed technique, or failure to prevent infection or contamination.

Connecting information with people has been a long-standing role for librarians and the ways in which this connection takes place are changing and expanding. The health sciences literature in the last several decades reveals a number of initiatives to increase the involvement of librarians in delivering information to the bedside. Determining the most efficient and effective ways of facilitating the diffusion of innovation to clinicians is an important and needed area for further research. Reports of programs such as clinical librarianship and the recent call for a new health professional, the informationist, have been largely anecdotal and hortatory (Lipscomb, 2000; Davidoff & Florance, 2000). The MLA and the NLM cosponsored a conference on the informationist concept in April 2002; a number of questions were raised about appropriate training, viable economic models, and the impact of the informationist on clinical outcomes (Shipman et al., 2002).[3] For example, systematic evaluation of clinical librarianship programs in a variety of settings, or a head-to-head comparison of multiple techniques would help determine which of these should be more actively pursued. Identifying variables and multivariate techniques to investigate how adoption of innovation takes place, and how this adoption can be encouraged are just two of many possible areas needing investigation.

Observation of information-gathering behaviors also contributes to developing delivery systems that actually work. Understanding the information behaviors of clinicians—how they seek information and how they apply it to practice—is a crucial first step in designing information delivery systems. In her 1998 review, Detlefsen concludes that the studies that have

been conducted have done little to build a theoretical framework from which to generate and test hypotheses. Furthermore, the environment in which most of these studies were conducted has changed dramatically. Detlefsen notes the potential effect of managed care; even more important is the growth of digital information. Often, these studies conclude that the clinicians do not have access to appropriate information (or they perceive that they don't) or that they do not understand how to use the information system and its results appropriately, or both. The enormous variety of specialties, the disparity among practice environments, and the number of varying information access points make it challenging to draw generalized conclusions.

Examining how information is used in order to design delivery systems is a high-stakes enterprise from which librarians can benefit in their efforts to find better ways of helping clinicians manage information in the course of their work (Ash et al., 2001). Librarians have an especially important contribution to make to this research. Because they have traditionally been personally and immediately engaged in assisting clinicians with information seeking, they are uniquely positioned to gather data by observation or survey, for example, that will augment the existing literature on information seeking and use. Librarians have already acquired considerable understanding in this area, as evidenced by the recurring chapters on information needs and uses in the *Annual Review of Information Science and Technology.* Extending this research stream further into health sciences is the next obvious and important step. Furthermore, the insights gained from this research are valuable to systems developers and producers both in the nonprofit and profit sectors, who are most interested in creating products and services for this market.

Knowledge management (KM) also offers an opportunity for applied research in health sciences. First developed in the business sector, knowledge management was adopted by corporate librarians as they have attempted to use its techniques to optimize those assets of an organization that reside in the heads of its employees—its knowledge workers. Knowledge managers elicit expertise, organize it, and make it available throughout an organization in order to deliver value to a business (Broadbent, 1998, p. 24). In a health care environment, knowledge managers can use and exploit the clinical expertise that resides in the organization and its professional staff to advance the mission of the organization. Knowledge management can also invoke "stored knowledge" that resides in external databases and knowledge sources in order to support and guide clinical decisions. While these appear to be fundamentally human activities, many KM applications are highly dependent on information technology. A recent example that should attract the attention of LIS researchers is a physician order entry system with built-in checks, balances, and alerts to create a "seamless web" in which the clinician no longer has to engage in information seek-

ing at all, but is "fed" information at a given point. Davenport and Glaser (2002) characterize one such clinical decision support system (CDSS) as having knowledge or information "baked in" because no separate information system need be pursued. Given the financial rewards available in the health care field, comparing a KM system that has an information intervention that is automatic and seamless against more traditional interventions mediated by information professionals raises questions that are urgent in their implications for the future of professional judgment.

Since it seems inevitable that CDSS will be an important tool for reducing medical errors, the design and development of CDSS can draw upon insights contributed by LIS research. LIS experience with point-of-use instruction embedded in catalogs and databases could be useful in designing CDSS and ensuring their use. Determining how the knowledge from the literature might best be "baked in" begs to be investigated. How can the findings of science be presented in ways so that they are accessible and useable by those charged with applying them? How can both literature-based and practice-based research evidence best be translated into machine-interpretable formats suitable to clinical decision support systems? In order for CDSSs to be built, there must be mechanisms to link the knowledge-based data to the system, to invoke it appropriately, and to update it consistently in a timely fashion. Can some formats that already exist—such as structured abstracts and enhanced indexing—be adapted for testing? And, can the results be disseminated to system developers and to opinion leaders within the health professions?

The kind of mandatory alerting and knowledge management that may be required for health care professionals differs from the delivery mechanisms traditionally offered to patients and consumers. While patients can be exhorted to become more knowledgeable and thus more responsible for complying with the course of therapy prescribed by their physicians, no such mandate currently exists for the well public. Because many, if not most, public library transactions take place by choice, examining information seeking behaviors and choices is a crucial research question. Consumers retain the freedom to choose whether to seek information and where and whether they will use it. The public library is a primary channel for this communication to take place, and designing systems for consumer health information dissemination is an important research topic. Describing the ways in which the general public can obtain high quality information and determining its effect on the health of the general population affects how libraries and librarians collaborate with the health care establishment. Some important lines of communication have already been established between the NLM, the MLA, and the American Library Association (ALA), in particular the Public Library Association division of ALA.

How to deliver information when and where it is needed in a form that will facilitate and encourage its use is an age-old question in library and

information science research, but the environment in which delivery of health information occurs continues to change. In the clinical arena, when patient care is at risk, information use by directive is becoming more acceptable. In such a scenario, information use cannot be avoided, and people become information users by force. In order for this to be acceptable to professionals, the information presented must be of the highest quality and relevance, or they will resist using the system that presents it. And indeed, some have expressed concern that automation has not always been beneficial and may negatively affect the ability of an organization to function effectively. Designing digital repositories of evidence drawn from multiple sources (literature, patient data, numeric values and statistics, for example) that can be shared among various audiences was recently named as a key area of research by medical informaticists; clearly it is a key area for librarians as well (Sim, 2001). In addition, testing the efficacy and cost-efficiency of decision support systems that involve a skilled human intervention versus those that are purely automatic has implications not only for physicians, but across many sectors in health care, particularly in nursing and in allied health, two areas that are frequently overlooked.

Library research has often focused on instructional effectiveness in helping users to navigate information systems. While there is certainly an argument to be made for including information literacy in medical school curricula and for providing updates to practicing clinicians, instruction is generally not viewed as an appropriate solution for clinicians. The real issue in demonstrating effective use of information in clinical care is reduced error and behavioral change. In this environment, instruction is important only insofar as education can be said to drive behavioral change. Questions that need to be asked include: "How can the rate of dissemination of information be increased so that behavioral change is effected?" "Does the human intervention of information professionals increase that behavioral change?" "Even if it does, is it affordable? Or, is the development of clinical decision support systems (CDSS) a more effective way to go?" "If the latter, how can the findings of research literature be made available in an efficient way so that they are incorporated into the CDSS in ways such that the integrity of the literature that librarians have come to know and value is preserved?"

## III. Economics: Developing an Effective Pricing Structure

Providing knowledge-based information—in whatever form and through whatever channel—has costs attached to it. If costs can be examined so that we understand the value of them, a price can be put on them. In the world of health care, discussions of price are inevitably driven by the question, "Who pays?" The answer to this question should lie in questions of value—To whom is the information valuable? Or in other words, what

difference does it make? If it can be demonstrated that availability of information makes a difference in outcome, in length of stay, in efficiency, in quality of care, then a third party such as an insurer is far more likely to cover the cost. If not, the cost is yet another "add-on" to an already enormous health care price tag. Despite the belief that something that affects a human life has value beyond the economic, the fact remains that belief systems that cannot also demonstrate economic value are far less likely to be implemented. Any discussion of economics, then, must originate with an examination of impact—what difference does it make?

The health science literature, and indeed the LIS literature in general, is sprinkled with studies that have attempted to address the impact question (Klein, et al., 1994; King, 1987; Marshall, 1992; Lindberg et al., 1993) These studies, though valuable, are limited in scope and generalization. Indeed, Urquhart and Hepworth (1996) compared several studies of the value of information to clinical decision-making and concluded that care must be taken when replicating a study in a different health context and culture and that multiple measures as well as openness to multiple outcomes are essential. Most studies are limited in that they also assume the intervention of an information professional; that is, they query clinicians as to whether an information intervention was helpful or not. A more useful question with less potential for bias is, "Does availability of information [in any form delivered through any channel] affect patient health care?" And even more interesting, "*How* does it affect patient care?" These questions, particularly if they are asked objectively without the possible bias of attempting to support the role of a particular kind of information intervention, are essential.

The MLA recently initiated a multiphase study aimed at determining the contributions of library and information services in health care. A preliminary taxonomy has been published that will serve as a basis for further research by generating hypotheses aimed at deriving the best approach for information centers to use in assessing their value (Abels et al., 2002). The underlying questions in the study are:

- What is the value of using library and information services to the hospital or academic health sciences center?
- What are the contributions that librarians, through the provision of services, make to the bottom line of the organization?

The taxonomy has five broad concepts that reflect the mission of hospitals and academic health sciences centers: clinical care, management of operations, education, research and innovation, and service. It builds upon and extends earlier work by Saracevic and Kantor (1997) who developed a taxonomy to assess the value of LIS to another specific population group—researchers. Saracevic and Kantor, however, concentrate on demonstrating the value of information to the *individual user,* while current and future research in health science must focus on the value of the information to

the *mission of the institution*—improved patient care (Abels, 2002, p. 279). Since reducing medical error results in both more effective health care, but also more efficient health care, it is of demonstrated value to an organization. Effective error reduction is a measurable result both in economic terms and in terms of quality patient care.

Bringing together organizations and institutions whose missions may be similar but whose practices, value systems, and cultures are different remains an enormous challenge, one whose resolution may lie beyond the ability of traditional research. Nevertheless, systematic observation and reflection, as well as political and economic models, may guide future activities. Determining what incentives are attractive to foster interorganizational cooperation is one area that might be investigated. Are there noneconomic incentives, for example, that will encourage the construction and adoption of standards across health care sectors? Another big challenge for development of informational systems is electronic publishing; questions of licensing, copyright, and fair use abound throughout the entire information transfer cycle. It is notable that the NIH and the NLM have taken positions on these issues. Some derive from what might be termed their "legacy"—their products are already "owned" by the U.S. government—and their choice—PubMed makes full text of selected journals available over the Internet through the MEDLARS systems. Because the NLM is both creator and publisher of some key information products and services, it has adopted the strategy "to use its own products and services as test-beds for technical and organizational approaches to organizing and managing digital information. The Library's goal is to gain experiences from concrete experiments so that it can contribute to the development of workable national standards and strategies and also provide useful advice to other publishers of electronic information" (Humphreys, 2000, p. 450). Despite these important and laudable moves, many questions remain. What are appropriate business models for electronic publishing, especially in areas where information is needed to advance health care? How do libraries, publishers, and scientific societies develop business models that address the key challenges facing the production, dissemination, and preservation of scientific information?

The design and implementation of effective delivery mechanisms—whether computer-based or human-based—is directly tied to the economics of health care, and the economy of health care information differs from other similar sectors in important ways. First, the major indexing system is in the public domain. The MEDLINE system and all its components are produced by the NIH, a federal agency, and therefore it costs much less to use MEDLINE than other databases in the sciences. Furthermore, it is available for research purposes at a reasonable cost. Second, the grants program of the NLM makes research into health informatics attractive and accessible to qualified researchers, particularly multidisciplinary teams. With these

resources available, there are opportunities to build a solid research base and armamentarium of tools that can be used both at the individual evaluation level but also at the level of large-scale research studies. Greater sophistication in articulating theory and identifying variables, as well as triangulation between qualitative and quantitative data, would advance understanding considerably. There is a continued need to assess the value of information services to the improvement of patient care. To the extent that library and information interventions can be shown to make a contribution to achieving any of the organization's mission-related goals, they contribute to the bottom line, even if the specific benefit of the contribution cannot be isolated or measured in monetary terms.

## IV. Digital Libraries, Information Access, and Individual Privacy

Research focusing on the role of information in health care ("informatics research") is conducted today in a changing political, economic, and social environment. In an informatics research agenda, the AMIA named several factors affecting health care informatics: the growing availability of health information, changing roles of health care consumers and providers, globalization, more fluid institutional boundaries, increased politicization of health care, and changing work standards and practices. These factors interact with the increased ability to create more integrated information systems capable of linking clinical, personal, and organizational performance data with the drive to develop computer based lifelong patient records and establish systems that are interoperable, even across international borders (Kaplan et al., 2001). Although this agenda originated from an AMIA meeting, health sciences libraries and librarians are part of this environmental evolution, as indicated earlier, because of their involvement in organizational changes brought about by the IAIMS report, Joint Commission on Accreditation of Healthcare Organizations (JCAHO) standards, and digital libraries.

The term "digital libraries" has become an accepted part of modern vocabularies, yet it often takes on varied meanings. In health care, digital libraries may include health record data as part of the library, leading them to be described as a "Web-era reformulation of the long-standing informatics goal of seamless integration of automated clinical data and relevant knowledge-based information to support informed decisions" (Humphreys, 2000, p. 444). When the scientific literature is seen as a collection of print-on-paper articles, and the patient medical record is a chart of handwritten notes, transcriptions and coding for financial reimbursement, the two appear to have little relationship to one another. But when they are converted to a digital format, each can be viewed as simply another node in the information transfer cycle. Furthermore, when the coding systems used to analyze and retrieve items are rationalized so that they interconnect, sud-

denly a web of patient data and knowledge-based literature emerges. The vision, funding, and architecture to create a method for these varied systems to interconnect originated with the NLM's Unified Medical Language System (UMLS) project in the mid-1980s. The UMLS maps relationships among various coding systems used in the medical environment such as the International Code for Diseases (ICD), Clinical Procedural Terminology (CPT), and Medical Subject Headings (MeSH). Constructing the UMLS has been an enormous and complex undertaking, one that probably could not have been accomplished without the resources of a major institution such as the NLM for which it was a priority. As the idea and the reality of IAIMS evolved, the value of a system capable of linking and integrating different types of digital biomedical information became increasingly recognized. Furthermore, it provides a workable example of a digital library, presenting the user with a coherent view of an organized, selected, and managed body of information.

When this goal was first formulated it was assumed that clinicians were the targeted beneficiaries of the program. As the audience for health information has expanded to include public health professionals, patients, and the well public (consumers), there is a need to make information available to support patients' participation in choosing treatments and deciding on strategies for managing their health problems.

Along with its obvious benefits, the availability and delivery of health information (knowledge-based literature, clinical guidelines, and health record data) has introduced many complex policy questions. Solutions to these questions will require investment in the production of better materials, training for clinicians and other information providers in how to use them, and the development of an accreditation system to help users to judge the quality of health information. Now that various systems can "talk" to each and data can be shared rapidly and easily across geographic, conceptual, and administrative barriers, what controls must be put in place to assure access while protecting privacy? Indeed, at the 2001 spring conference of AMIA, a series of recommendations for public health informatics recognized that a major challenge is to develop "coherent, integrated national public health information systems that will integrate efforts between public health and clinical care systems and will address pervasive concerns about the effects of information technology on confidentiality and privacy" (Yasnoff et al., 2001, p. 536). It can be easily seen that the research questions that emerge from the creation of the "seamless web" extend beyond technology application and evaluation into policy analysis. Some of the policy research may be guided by the increasing involvement of the library community in the design and delivery of consumer health information.

## SUMMARY

Research in the health sciences is characterized today by a need for multidisciplinary approaches—not just in methodology but through real collaboration. Health care is a major factor in national economies, and it affects everyone. Those for whom information is a central concern are challenged to describe how information makes a difference in health. Making sure that clinicians are provided with the best information that truly describes effective therapies, ensuring that consumers and patients have access to reliable information, and determining how best to deliver that information in a form that will be used are enormous tasks. While research alone cannot change the world, it can provide insight and direction to those who are in a position to take steps that will make a difference. Health sciences librarians and those who are concerned about the future of health sciences libraries are in a position to bring their expertise, their values, and their commitment to ensuring that the information infrastructure that supports health care decisions is the best it can be and that it is available to all who choose to use it.

## NOTES

1. The history of the Research section, written by Robert Braude, is available at http://research.mlanet.org/. Accessed November 7, 2002.
2. For a discussion of the impact on hospital libraries of both IAIMS (Integrated Academic Information Management Systems) and JCAHO (Joint Commission on Accreditation of Healthcare Organizations), see Doyle, J.D. (1999). IAIMS and JCAHO: Implications for hospital librarians. *Bulletin of the Medical Library Association 87*(4), 383–386 and Schardt, C. M. (1998). Going beyond information management: Using the Comprehensive Accreditation Manual for Hospitals to promote knowledge-based information services. *Bulletin of the Medical Library Association 86*(4), 504–507.
3. Additional information about the informationist conference is available from the Web site of the Medical Library Association at http://mlanet.org/research/informationist. Accessed November 4, 2002.

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# Determining How Libraries and Librarians Help

JOAN C. DURRANCE AND KAREN E. FISHER

## ABSTRACT

THIS ARTICLE EXAMINES THE QUESTION, "What differences do libraries and librarians make?" primarily from the perspective of geographical communities. The article first states the reasons why this is an essential research question and describes the contributions of current public library planning tools to the determination of impact. It then takes a broad look at the framework that is essential for the intellectual development of this topic and the ability to answer the question, including methodological approaches and theoretical frameworks that will be discussed throughout. While the authors pose this research problem as an evaluation question, this article examines contributions of research in several areas—particularly professional practice, especially reference research that has been informed by qualitative methods—to its solution. Finally, the authors examine approaches to studying context as a framework for determining the impacts of library services and include a brief presentation of findings from a recent study of "How Libraries and Librarians Help: Context-Centered Methods for Evaluating Public Library Efforts at Bridging the Digital Divide and Building Community," funded by the Institute of Museums and Library Services (IMLS).[1]

## WHAT DIFFERENCES DO LIBRARIES AND LIBRARIANS MAKE IN A COMMUNITY? THE BASIC QUESTION RESEARCHERS AND LIBRARIANS FAIL TO ANSWER

Periodically, the field becomes aroused because libraries have been overlooked in a landmark study of societal institutions, ignored in a major government report, or omitted from important legislation that could improve

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 541–570

libraries' capacity to contribute to the solution to a societal problem. Why, professionals ask themselves, could the library have been ignored in this major study of X or this major federal initiative involving Y? In an essay entitled "Where are Libraries in *Bowling Alone*?" Jean Preer, like many before her, bemoaned the fact that "libraries are notably absent" from the consciousness of a major researcher or decision-maker. In this case the work was Robert Putnam's "compelling and widely-heralded work" on social capital (Preer, 2001, p. 60; Putnam, 1995; Putnam, 2000). Throughout her short article Preer asserts (to the readers of *American Libraries*) that libraries do, indeed, foster social capital, and that Putnam has ignored their contributions. She argues that for more than a century public libraries have worked to create an informed citizenry and to build community. Preer concludes that libraries contribute to most of the conditions that Putnam predicts will create "a more engaged civic and community life" including stimulating the civic engagement of young people and fostering tolerance, arts and cultural activities, and activities that inform citizens (Preer, 2001, p. 62).

Documenting the number of times the kinds of concerns raised by Dr. Preer have been voiced would fill many more pages than are allotted for this entire issue. At one point Preer quotes 1934 ALA President Gratia A. Countryman's response to the absence of libraries in a major 1930s study of American life: "What have we done or not done that this can be so? Why is it that we have not impressed ourselves, as an important and essential institution, upon the governing body or upon intelligent authors and scholars? Is it in the very nature of our work that it should be so, or is it in ourselves?" (Preer, 2001, p. 62). Since that time libraries have been absent from scores of major studies of societal issues, major legislation designed to solve societal problems, and the funding priorities of a number of foundations.

Preer's frustration "That Putnam could miss the connection is a distressing reminder of the way in which libraries are simultaneously ignored and taken for granted" reflects the frustration expressed by generations of librarians and researchers (Preer, 2001, p. 62). Putnam, of course, is only one of many influential individuals or organizations over the decades who have lacked the awareness of existing and potential impacts of library services necessary to assess libraries' contributions to the solutions to particular societal issues or problems. It is easy to replace "Putnam" with any number of major researchers, the federal government, the media, local decision-makers, etc. The sheer number of individuals and institutions who have failed over the decades to see the contributions of libraries to society should alert the field that the messages currently being sent do not convey the contributions that libraries and librarians make to their communities.

Authors in this issue were charged to identify significant and researchable questions, describe prior research that could prove useful, and suggest methodologies for future work. This article addresses the broad question, "What differences do libraries and librarians make in the lives of individu-

als, their families, neighborhoods, the community organizations that serve them, and the larger community?" It is essential to realize that this basic question has been elusive for a century. Librarians as a profession have been committed to excellence during this entire period, but have lacked the tools that could provide the answers. Efforts of librarians to quantify excellence for several decades were focused on standards, inputs, and more recently, outputs, none of which are capable of answering that question. In the last decade of the twentieth century two quite different external forces—1. the radically changed environment in which libraries operate, and 2. the pressure from external agencies for institutional accountability—brought this question to the attention of both librarians and researchers.

## The Imperative: Why This Question Must Be Answered

There is a major demand across the public sector for accountability that began, coincidentally, with the development of the Internet. This demand began at the federal level of government: "Fiscal conservatism, the devolution of responsibility to the states, and skepticism about social programs [are now driving both evaluation and] national policy making" (Rossi et al., 1999, p. 19). In a recent article these authors addressed this important question from the perspective of pressures that are forcing librarians to begin to seek out indicators and measures of outcome (Durrance and Fisher-Pettigrew, 2002).[2] In that article we discussed the convergence of factors within and outside of librarianship that has created an environment conducive to the development and use of indicators of impact of library services. Advances in evaluation research are certainly an important enabling factor. More importantly, however, demands for public-sector accountability and governmental activities aimed at determining service outcomes have driven the widespread need in the public sector (and among nonprofits) for identifying and adopting outcome measures.

Reflecting a loss of citizen confidence in the work of governmental agencies, the 1990s brought a convergence of thought among decision-makers that federal, state, and local governmental agencies, institutions, and nonprofit organizations must begin to reshape public services and products to focus more on accountability. During that period the U.S. federal government identified reinventing government as a priority and focused on developing approaches government agencies could use to demonstrate their accountability (Osborne & Gaebler, 1992). Two federal initiatives have guided these government mandates: the Government Performance and Results Act (GPRA) of 1993 and the Government Accounting Standards Board Concepts Statement #2 in 1994 (Institute of Museum and Library Services [IMLS], 2000; Multnomah County Auditor's Office, 2000). GPRA requires every government agency "to establish specific objective, quantifiable, and measurable performance goals for each of its programs. Each agency must annually report to Congress its level of achievement in reaching these goals"

(Sheppard, 2000). "When GPRA is fully implemented, it will directly impact state and local governments that receive Federal funding by requiring them to report on program results" (Multnomah County Auditor's Office, 2000, p. 2). Thus, demand for public sector accountability is a key factor in the changing evaluation horizon across the public sector.

The federal agency most concerned with public library development and excellence, IMLS, poses the question, "What differences do libraries and museums make?" While the federal government, through the work of IMLS, demands that librarians develop measures of outcome that will indicate "benefits to people: specifically, achievements or changes in skill, knowledge, attitude, behavior, condition, or life status for program participants" (IMLS, 2001), the approaches most commonly used to evaluate libraries are still focused on the institution rather than its users. IMLS has warned that "if museums and libraries do not take the responsibility for developing their own set of credible indicators, they risk having someone else do it for them" (IMLS, 2000). These moves toward accountability bring the public sector into an era of mandated development of outcomes. Because there is now an urgency to articulate messages that resonate with those who influence public policy decisions, there has been a rush to develop ways to measure outcomes. It is essential that this work is informed by relevant research.

## Today's Public Library Planning and Assessment Tools

For well over a century, the public library, an American invention, has worked to make contributions to the lives of citizens of the community. The literature of that effort is quite extensive and out of the scope of this article. We note, however, that this literature examines the broad-ranging roles that public libraries have undertaken in their communities (Molz & Dain, 1999; Van Slyck, 1995). The breadth of services undertaken by this institution led over time to the development of several generations of planning tools that have increased public library planning effectiveness and the development of effective mission statements, goals, and objectives (Palmour et al., 1980; McClure et al., 1987; Himmel & Wilson, 1998; Nelson, 2001).

These tools have fostered a new generation of mission statements that seek to distill the library's purposes and values while articulating the approaches used to fulfill them. Statements developed today often emphasize the needs the library seeks to meet. Mission statements reflect the desire of librarians to show that libraries serve a vital role in their community. Public library mission statements increasingly are framed to indicate the value of the public library to the community from the perspective of its contributions to the lives of citizens. Mission statements show that libraries seek to:

- "promote the development of independent, self-confident, and literate citizens";[3]

- "enhance the personal development" of citizens "by seeking to meet their informational needs, recognizing the benefits to the community of a well-informed citizenry, the individual's capacity for self-improvement, the worth of each person and the need for human dignity";[4]
- "inform, enrich, and empower every individual in its community by creating and promoting free and easy access to a vast array of ideas and information and by supporting lifelong learning in a welcoming environment."[5]

These mission statements could lay the groundwork for developing more effective indicators of the impacts of public libraries in their communities and help shape the activities that lead to relevant community outcomes.

Unfortunately, the planning and assessment tools mentioned above fail to provide mechanisms to move public libraries to make the conceptual leap involved in developing outcomes based on these strong statements of commitment to the community. That is a big order, and the research that would support these actions has been slow to materialize. Therefore, these tools still focus evaluation efforts on public library output measures. These measures, in use for nearly twenty years in one form or another, were designed to move public libraries beyond the time-honored, but limiting, measure of circulation. Developers added other measures of use, including annual library visits, in-library materials use, turnover rates, program attendance, and reference questions, etc. These measures, first introduced in the 1980s, all include a calculation to determine per capita usage, and provide tested approaches to collect and analyze data on a variety of indicators of library use (Nelson et al., 2000; Van House et al., 1987). The output measures began as a well-intentioned move away from heavy reliance by public libraries on input measures mandated by public library standards. Public librarians, state agencies, and the federal government have come to rely on output measures for public libraries as indicators of public library effectiveness. While the primary values of these measures are as indicators of efficiency and use, they do not reflect value gained by the user. Yet, output data are being collected on a statewide basis by state library agencies and analyzed at state and federal levels.

Further, output measures, particularly those focusing on circulation and materials, have become the basis for additional, related measures including the controversial Hennen's American Public Library Rating system (HAPLR). The HAPLR weighting system compounds the emphasis on circulation by factoring this element into the index at least six times (cost per circulation, collection turnover, circulation per FTE hour, circulation per capita, circulation per hour, circulation per visit). Hennen has used the HAPLR index to identify the "best" libraries in the nation (Hennen, 2002).

Certainly the data suggest that high circulation coupled with low staffing costs appear to be the key to an effective library. Librarians who use HAPLR to evaluate their libraries are likely to focus their energies in those areas that are emphasized by this index. It is not difficult to imagine that HAPLR libraries will add multiple copies of currently requested materials, especially videos and other materials whose circulation periods are short, to increase their score, since the HAPLR has selected and featured the "top" libraries in the nation. There is no doubt that some of the libraries on the top of the HAPLR list are some of the best in the nation, but these institution-focused measures fail to determine the contributions of these libraries to their communities.

An attempt to overcome this weakness in the planning tools and to provide a bridge to outcome measures was undertaken by researchers at the Colorado State Library's Library Research Service (LRS). LRS worked with selected libraries that use the *Public Library Association's Planning for Results* guides by designing data collection instruments for several categories derived from the original thirteen *Planning for Results* service responses (Steffen et al., 2002; Steffen and Lance, 2002; Lance et al., 2002). LRS's *Counting on Results* (CoR) project worked with forty-five test public libraries to collect outcome data on six library service responses that had been modified by participating libraries and CoR researchers—Basic Literacy, Business and Career Information, Library as a Place (Commons), General Information, Information Literacy, and Local History & Genealogy. Researchers worked with librarians to identify candidate outcomes and then developed for participating libraries a standard oversized postcard survey form for each of the modified library service responses to determine the extent to which each outcome was present in each library. This approach resulted in the identification of a range of candidate outcomes that librarians conjectured might emerge from the chosen service responses.

The researchers indicate that more libraries (twenty-five) distributed and collected survey forms on General Information (GI) than any of the other service responses.

> [GI] outcomes were the most popular, including the highest percentage of respondents for a single outcome. Indeed the least popular GI outcome was more frequently reported than the least popular outcomes for other responses. These trends indicate that not only does this [service response] apply to the greatest number of libraries, it is also the most relevant to the largest number of library patrons. (Steffen et al., 2002a)

The most widely reported outcome—"read for pleasure"—however, fails to capture the essence of an outcome—in other words, "achievements or changes in skill, knowledge, attitude, behavior, condition, or life status for program participants" (IMLS, 2001). For this most popular service response, it appears that librarians and researchers identified a relatively weak set of

candidate outcomes, in all probability because they failed to collect data resulting from specific GI encounters by library users.

On the other hand, the candidate outcomes suggested by librarians and *Counting on Results* researchers for more focused services where librarians are more likely to understand their users better provide more promise. This is seen in the Business and Career Information SR, where some respondents agreed that they had "developed job-related skills," or in Basic Literacy, where selected respondents responded that they had "became a citizen" or "prepared for the naturalization exam" or "helped a child do homework or improve grades" (Steffen et al., 2002). CoR researchers, however, were concerned that: 1. some survey questions (such as "became a citizen") may have been misunderstood, and 2. the more focused surveys yielded very few responses to most of the project's selected outcomes. The data also suggest that the methods used to collect outcome data need to be designed to capture the context of a specific service model. Contextual outcomes will be discussed later in this article.

This early set of candidate outcomes for public libraries brings both promise and concerns. The focused service responses offer the most promise. However, they may not measure the full impact of public library services since they were not generated through user-focused research. Rather, they were identified first by librarians and then tested with a broad range of users. Thus, if librarians *underestimate* the impact of their services and then test these guesstimates, the measures they choose will not reflect the full impact of their services.

## The Contributions of User-Focused Research on Reference to Understanding Impact

Research on the reference interview, discussed below, has made strong contributions to our understanding of the impacts of library service. This research—which arose to answer one question: how accurately do librarians answer questions?—evolved over time to focus on theoretical approaches to the nature of the interaction and can be thought of as a model for examining the emerging research that will answer the question, "What differences do libraries and librarians make?" Along the way, researchers not only identified a range of negative outcomes of poorly constructed reference interviews, but they also showed that the integration of research findings into professional practice resulted in improved outcomes.

### *Gains from Reference Research*

Research on the reference interview in the past several decades has been transformed from what had been considered a topic far too difficult to be amenable to effective research studies to a synergistic body of knowledge that can elucidate the context of seeking information from a mediator or system. The small, but representative, sample of several decades of

research on the practice that librarians call reference—particularly research findings that have been shaped by the effective use of qualitative research approaches—shows that what is considered a researchable question in LIS, just as in other fields, has built on the questions raised and partially answered by a succession of researchers. The most effective work in translating these knowledge gains based on research into practice—and ultimately providing a framework for reference librarians to use to more effectively help people solve their information problems—has been done by Catherine Ross and Patricia Dewdney and more recently by their colleague Kirsti Nilsen (Ross & Dewdney, 1998; Ross et al., 2002).

While it took some time for synergistic outcomes to appear, it is clear now that the knowledge gains made in this area have helped us to begin to answer the question, "how do libraries and librarians help?" Starting with Robert Taylor in the late 1960s, researchers began to realize that reference, long thought to be an art that was difficult to transmit to novices, was a potentially rich research problem (Taylor, 1968). Much of the research discussed below made use, at least in part, of qualitative methodologies.

*Early Research Questions*

A number of researchers, most recently Ross, Nilsen, and Dewdney, have traced the considerable research knowledge gains in the thirty-year period that began since the pioneering work of Terry Crowley and Tom Childers (Ross et al., 2002; Radford, 1999). The early research that spawned such a rich body of knowledge sought to measure the effectiveness of reference by determining accuracy rates using questions developed by the researchers. The answers to that early research question (how accurately do reference librarians answer questions?) raised even more interesting research questions (such as, is this the right question for the researcher to ask?) that were amenable to qualitative approaches. The unobtrusive approaches used by Crowley and Childers and replicated repeatedly by scores of other researchers in the 1970s and 1980s showed that librarians consistently failed to accurately answer factual questions about half the time (Hernon & McClure, 1986). Very importantly, however, by the early 1970s researchers had learned that one of the major ways that librarians interact with people, the reference encounter, was a very researchable problem.

*The Process of Building on Previous Research*

The early work of Crowley and Childers sparked the interest of other researchers such as Lynch (1978) whose own work continued the synergistic knowledge gains. Additional gains in knowledge about how librarians help (and hinder) emerged from the research by Dewdney (1986). Both Lynch and Dewdney determined that, when actual interviews were recorded in their natural setting using unobtrusive approaches, the research problem was actually fairly complex. Many questioners in libraries phrased questions from a system perspective, "Do you have any books on?" People often

failed to state their information needs in the initial question. This research, using real interviews, also showed that far too often, approximately half the time, the staff member answered the question directly rather than negotiating it, resulting in a failure by the questioner to get a satisfactory response from the librarian (Ross et al., 2002, p. 8). Research studies during the 1980s and 1990s identified specific approaches used by librarians that hinder rather than help those who seek information. Researchers also learned in that period that accuracy, while a noble goal of practice, was not the single or perhaps even the best measure of reference effectiveness because it focused on the question rather than the questioner.

Durrance's research, using unobtrusive approaches and questions formulated by observers, proposed and tested a new indicator—willingness to return to the staff member in the reference interview—against a variety of interpersonal and search variables and found that interpersonal variables are key to the success of the interaction (Durrance, 1989, 1995). This research and that of Dervin and Dewdney (1986), Dervin and Clark (1987), Dyson (1992), Dewdney and Ross (1994), Ross and Dewdney (1998), and Ross et al. (2002) show how particular communication approaches and behaviors (the use of open questions, follow-up questions, attention to closure, etc.) boost the effectiveness of the reference interaction. Dyson and her colleagues showed that librarians could be taught to improve the reference experience for questioners by identifying and overcoming common failures (Dyson, 1992).

*Job and Career Centers—Community Information Reference Services*

The recession of the late 1980s and early 1990s brought new, community-focused, need-based services to public libraries that built on knowledge gains made by reference researchers, especially that work that had been conducted in public libraries. These community-focused services, including Job Information Centers (JICs), also helped librarians understand the information needs of job seekers, including blue collar workers who had lost the jobs they had held for decades, displaced homemakers, and professionals unable to get work in a declining economy. Several years ago Durrance identified a rich set of strategies used by staff of a number of job and career information centers (Durrance, 1991a, 1991b, 1993, 1994). Staff noticed that many of those who used job centers were not typical library users and did not understand the library as an information center. They saw people who were desperate to get information about the job market and how they fit into it. Staff in these centers began to sort out the variety of needs that people who are unemployed or underemployed bring to a trusted community resource (in this case, the library). They used a variety of approaches including computer software to help people assess their skills/options. Staff were well connected in the community and so collaborated with other agencies. These activities facilitated appropriate referrals to other

community organizations. Staff expanded their array of resources by providing a broad range of computer, video, and print resources on jobs and careers. They began to provide specialized reference services, including answering an array of questions that built on each individual's situation. They also honed the interviewing skills of staff and provided access to advising and career counseling sessions by appointment. Focusing on the needs of their clientele, job center staff developed workshops that focused on specific needs such as resume writing, interviewing, starting a business, etc. (Durrance, 1993, 1994). As a result, staff in these libraries realized that they were making a difference in the lives of their clientele through the numerous testimonials they and their administrators received, although at that time *no tools* existed to help them systematically document their contributions to the community. Durrance (1994) developed preliminary evaluation approaches to help bridge this gap.

*Contributions of Theoretical Frameworks to Reference Research*

Application of theoretical frameworks during the 1980s and 1990s further enriched researchers' ability to more effectively focus on the questioner. Dervin's theory of sense-making has been used by researchers to show that the best responses to queries are those that help users solve the problem behind the question (Dervin & Dewdney, 1986). This theoretical framework has led to the development of more effective approaches to the reference interview through the use of sense-making questions. (For a summary see Ross et al., 2002, pp.93–101.) It appears that successful outcomes for users have increased because professionals have learned how to employ these approaches effectively (Ross et al., 2002, p. 98).

The application of the theory of mental models, while not as widely used as sense-making, has the potential for making strong contributions to knowledge growth and improved professional practice. Cognitive scientist Donald Norman and others developed the theory of mental models to better understand the major discrepancies between the user and developers of systems. "In interacting with the environment, with others, and with the artifacts of technology, people form internal mental models of themselves and of the things with which they are interacting. These models provide predictive and explanatory power for understanding the interaction"; further, "[p]eople's mental models are apt to be deficient in a number of ways, perhaps including contradictory, erroneous, and unnecessary concepts. . . ." In short, they are "messy, sloppy, incomplete, and indistinct" (Norman, 1993, pp. 7, 14).

Gillian Michell and Patricia Dewdney, using this theoretical framework, show that it can successfully elucidate the intractable problem first identified by Lynch (1978) and Dewdney (1986) of poorly formed user queries coupled with a tendency among many librarians to take these ill-formed questions at face value (Dewdney & Michell, 1996; Michell &

Dewdney, 1998; Michell & Dewdney, 2002). This phenomenon—drawn from linguistics and called "ill-formed query" by Dewdney and Michell—is applied to "a question that doesn't work because it leads to erroneous inferences" (Ross et al., 2002, p. 22). Their research shows that ill-formed questions often lead to reference interaction failure. The Michell-Dewdney Mental Models Study compares the mental models of questioners with those of librarians by observing actual reference interviews and then interviewing both the user and the librarian. This research examined the following questions: "Does the librarian's understanding of the system (including the collection and its organization, the physical layout, her own role in that system, and the characteristics, values and beliefs of the user) differ in any important way from the user's understanding of that system and its role with respect to the situation from which the information need arose, the user's beliefs and attitudes towards libraries as places to solve problems, and the uses to which the user plans to put the information? If there is an important difference, does either the librarian or the user discover it, and how does that discovery affect the outcome of the transaction?" (Michell and Dewdney, 2002). The theoretical framework and the methods used to collect the data have allowed these researchers to show *how* the user's mental model of the transaction (and to some extent of the library system) differs from that of the librarian. This theoretically based research further helps researchers and practitioners understand the important discrepancies in the mental models of librarians and questioners. The next section of the paper focuses on more theoretically driven information behavior research which has brought about a greater understanding of social contexts.

For several decades theory has shaped the research focused on information behavior. The section below discusses, in particular, research that has begun to focus specifically on understanding social contexts.

## Context: A Framework for Determining Impact

Marcia Bates, one of the field's most distinguished LIS researchers, has identified the three key questions associated with LIS research (Bates, 1999). They are:

1. The physical question: What are the features and laws of the recorded-information universe?
2. The social question: How do people relate to, seek, and use information?
3. The design question: How can access to recorded information be made most rapid and effective?

Bates' second question drives the work of numerous researchers across the world who study information behavior that is surely related to the question of "What differences do libraries and librarians make?" Yet in the late 1990s, Jorge Schement warned that librarians "lag in [their] understanding of the

evolving social context—a context in which libraries will have to justify themselves," and suggested that libraries consider "how Americans [will] live their lives as citizens, as economic actors, and as social beings" in the coming decades (Benton Foundation, 1997, p. vi). The research framework discussed below will make increasing contributions to practice as librarians move to determine the impacts of their professional contributions and those of their institutions.

*Recent Research that Informs Context*

In a recent ARIST review, Pettigrew, Fidel, and Bruce (2001) synthesize recent advances and conceptual growth in the field increasingly known as information behavior research—defining this research as "the study of how people need, seek, give and use information in different contexts, including the workplace and everyday living" (Pettigrew et al., 2001). These authors show the role of theory in shaping research on information behavior, providing examples of information research that has "focused on the user as an individual, cognitive being and on the behaviors associated with information processing" (Pettigrew et al., 2001). They remind us of the rich knowledge gains by information behavior researchers informed by the theoretical work of Dervin, Kuhlthau, and others. This most recent literature review of information behavior research shows a greater focus by researchers on context.

Seeing the need for a better understanding of contextual factors, researchers looked to a new vehicle for sharing context-focused information behavior research, the international conference, Information Seeking in Context (ISIC). An increasing number of researchers have begun to shape our understanding of context since the first ISIC Conference in 1996 (Vakkari, et al., 1997). This emerging body of context-focused research should make strong contributions to the question, "What differences do libraries and librarians make?" Carol Kuhlthau warns that "[to neglect context] is to ignore the basic motivations and impetus that drives the user in the information seeking process" (Pettigrew, 1999, p.802).

## Methodology

*Knowledge Gains Resulting from Qualitative Methods*

Throughout this article qualitative research methods and approaches receive particular attention because it is the assumption of the authors that this framework provides the researcher with a variety of tools that can be used to understand the complex interactions that shape phenomena of study including the impacts of libraries and librarians on society.

Qualitative research, as defined by Creswell, is "an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and con-

ducts the study in a natural setting" (Creswell, 1998 p. 15). "Accordingly," Denzin and Lincoln (2000) add, "qualitative researchers deploy a wide range of interconnected interpretive practices, hoping always to get a better understanding of the subject matter at hand" (p. 3). The use of qualitative approaches allows the researcher the flexibility to look closely to describe and explain. These frameworks, especially when informed by theory, bring a user perspective to agency evaluation. Qualitative approaches can "illuminate aspects of libraries, library services, and library users' perspectives in ways we have not had access to in previous research" (Lincoln, 2002).

LIS has benefited over the past two decades from work done by researchers using qualitative approaches. For example, starting in the 1980s, Carol Kuhlthau's extensive work on the information search process has used theoretically grounded qualitative approaches to give the field not only a framework for understanding a range of cognitive and affective states associated with the search process (factors that strongly influence the outcomes of any search), but also an understanding of the various—and very different—stages of the search process. Kuhlthau's research has shown that these now well-known stages—initiation, selection, exploration, formulation, collection, and presentation—can be understood both by those who experience them and by information professionals who can, by understanding them, develop appropriate intervention strategies (Kuhlthau, 1991, 1993, 1994, 2001). A longitudinal study of her initial group of informants indicated the positive impact on the seeker of understanding the search process (Kuhlthau, 1999).

Pioneered by Brenda Dervin in the 1970s, sense-making studies employing qualitative methods have been conducted for decades (Dervin et al., 1976). This work has made strong contributions to information behavior research; it can also be seen as contributing to an understanding of the impact of library services. In a project funded by the State Library of California, Dervin and Clark (1987) identified a range of user-identified "helps" (outcomes) associated with public library services. Dervin's categories of "helps," framed from the perspective of the general library user, included: got ideas/understandings about something; accomplished something; decided what to do or when or how to do it; got rest and relaxation and a quiet retreat; got motivated to do something; felt good about myself, my decision, my circumstances; calmed down and eased my worries; felt like I belonged and was not alone; got pleasure, entertainment, and happiness. The purpose of Dervin and Clark's overall study, which was well ahead of its time, was to bring sense making approaches to librarians so that they might collect use data "in human terms" (Dervin & Clark, 1987, p. 1). These methods laid the groundwork necessary to determine the outcomes implied in the research question examined in this article. Most information behavior researchers who use qualitative approaches also enrich this research through theory application and development.

*Evaluation Methodologies*

Determining the differences libraries make is most often framed as an evaluation problem. Evaluation is generally seen as the assessment of various aspects of programs, including: "(a) the need for the program, (b) the design of the program, (c) the program implementation and service delivery, (d) the program impact or outcomes, and (e) program efficiency" (Rossi et al., 1999, p. 33). Evaluation as a social science came of age in the 1970s (Rossi et al., 1999, p.11). As evaluation as a field has matured, evaluators have increasingly employed qualitative approaches to evaluation questions. Indeed, 20 percent of the authoritative Handbook of Qualitative Research is devoted to an examination of "The Art and Practices of Interpretation, Evaluation, and Representation" (Denzin & Lincoln, 2000, pp. 870–1065).

In fact that bastion of the scientific method, the National Science Foundation, has funded evaluation studies employing qualitative methods. For example, the NSF-funded study conducted by Mark et al. (1997) effectively used qualitative approaches to determine the benefits of community technology centers. The authors reported that using a community technology center brought, in aggregate, a variety of benefits, including *work-related benefits* such as improved job skills, improved computer skills, access to employment opportunities; *educational benefits* including an improved outlook on learning new skills and knowledge; a variety of *personal efficacy and affective outcomes,* including general life improvements, confidence-building, a changed outlook on life and future prospects, feelings of accomplishment and hope, and changes in the use of time and resources; *increased civic participation and changes in social and community connections*; and *increased technological literacy* (i.e., improved perceptions of technology as a means to achieve individual goals). Research conducted by the authors of this article and discussed in the final section of this paper shows similar gains in community-focused public library services.

While librarians engage in evaluation, their most common focus is on efficiency measurement (as seen in output measures). All types of libraries for nearly two decades have collected performance or output data. A more recent trend, brought about by the governmental pressure discussed above, has been the call for more accountability; in other words, answers to the question, "what difference does this agency make in terms of those who use it or depend on its services?" This call for accountability, determining the value of a program based on those that should benefit from it, requires incorporation of consumers into the formula. This has meant that evaluation research has incorporated more use of qualitative methods. Rossi et al. (1999) note that "incorporation of the consumer perspective into evaluation research has moved the field . . . into the policy arena" (p. 13).

Increasingly, researchers within LIS have determined that the time is ripe for concerted efforts at developing appropriate evaluation research.

In a monograph that resulted from a recent ASIS session on evaluation, Cliff Lynch wrote, "The answers we can supply today aren't good enough. We cannot currently measure outcomes and effects systematically with much success" (McClure & Bertot, 2001, p. 320). Lynch (1978) says that evaluation questions are amenable to the kind of intellectual effort that goes into studying societal "grand challenge" problems. He suggests that the "time is ripe for grand challenge problems in information science and networked information, particularly in areas related to evaluation, given the importance of the public policy choices we face today involving IT and the growing emphasis on accountability of our institutions" (McClure & Bertot, p. 314). In sum, recognition by librarians, funding agencies and researchers have created a climate for the kind of research that can help libraries more effectively articulate their contributions to society. It is premature to predict the outcomes of such research, but there is no question that it will change the way that librarians think about their practice and, as a result, will change the practice itself. As evaluators have known for decades, people do not evaluate what they do, they do what they evaluate.

Philip Doty, examining evaluation issues from a policy perspective, urges rethinking of current approaches to evaluation (referenced in McClure & Bertot, 2001). Doty sees "the birth of a richer and more complex policy analysis—one that is more catholic in its methods, more self-conscious, more sensitive to narrative and values, more ethnographically sophisticated, and more aware of the limitations of all its methodological resources" (p.230). Doty proposes that researchers "put their research emphasis on "(1) the user of networked technologies grounded in a social setting; (2) the naturalistic investigation of technologies' situated uses, meanings, and related practices; and (3) the achievement of democratic, participatory design and social relations" (McClure & Bertot, 2001, p. 247).

Carol Hert seeks "to provide a connection between user-centered evaluation processes and system design" (Hert, 2001, p. 165). She draws both on the theoretical approaches of information seeking and use and those of human-computer interaction to develop a framework for the development of metrics for user-centered evaluation. She recommends that evaluators develop metrics derived from theoretical conceptualizations, undertake constructivist approaches, "educate the design community about the potential of various kinds of user studies" (p. 168), and develop approaches to "transform results into design decisions" (Hert, 2001, p. 160). Saracevic (2000) developed a conceptual framework for evaluation that identifies five distinct areas that are the subject of evaluation of digital libraries; these include societal, individual, and institutional factors, as well as the interface and, of course, the content. Unruh et al. (2000) have introduced a framework for the evaluation of digital community information systems.

The work of Peter Hernon and his colleagues on service quality is a strong addition to the LIS's knowledge of evaluation. (Hernon & Dugan,

2002; Hernon & Nitecki, 2001; Hernon & Altman, 1996; Hernon & Altman, 1998). Peter Hernon and Ellen Altman's (1998) customer-centered approaches are designed to move librarians beyond what they call the "countables" (input and output measures). This study builds on previous work by LIS evaluation researchers and provides an extensive overview of service quality with a focus on the customer, a carefully chosen term. With some urgency Hernon and his coauthors consider the importance of understanding and developing their customer base at a time of rapid change and discuss a variety of approaches to measure service quality: "some academic administrators, members of city government, and others question the role of, and even the need for, a library; after all, they assume everything—or everything worth knowing—is, or will be, available on the information superhighway" (Hernon and Altman, 1998, p. 211).

Digital library researchers have begun to examine the social aspects of the design, use, and impact of information systems (Kling, 1997, 1999, 2000; Bishop et al., in press). Bishop and her colleagues (2000) argue for the inclusion of participatory action research in the study of the design, use, and impact evaluation of digital information systems (Bishop et al., 2000). Participatory action research demands relevant outcomes for marginalized members of society. It seeks to enhance the problem-solving capacities of local community members by actively involving them in every phase of research—from setting the problem to deciding how project outcomes will be assessed. In this approach, the intended users of a digital library participate as researchers, not subjects. Bishop et al. (2000) use scenarios developed by the target audience in the design and evaluation of services. They found that "scenarios empower potential users as initiators in the analysis of information about their expectations and requirements, rather than treating them as mere informants in the design process" (Bishop et al., 2000). They note that scenarios are needed to develop "a more complete picture of the social context of information-seeking and technology use for those marginalized groups who are often on the fringes of system design and evaluation" (Bishop et al., 2000).

In short, evaluation in LIS is in a state of creative turmoil realizing that current approaches and tools fail to reflect the changes brought about by the digital revolution. Evaluation issues are beginning to be addressed by researchers and at meetings initiated by federal agencies such as IMLS, major associations including a focused midyear meeting organized in 1999 by ASIS that spawned a monograph on the topic, and recent interdisciplinary meetings including the several workshops on evaluation of digital libraries developed by the European-based DELOS Network of Excellence on Digital Libraries (McClure & Bertot, 2001).[6] The field is closer now than ever to harnessing the energies of a critical mass of researchers interested in new approaches to evaluation that will incorporate the radically changed library environment.

When asked in 1999 how effective their current evaluation tools were in providing them data on the benefits of their community information services in their community, librarians resoundingly said that current tools were grossly inadequate (Durrance & Fisher-Pettigrew, 2002, p. 47). Evaluation tools and approaches should be able to provide tools that will be used by librarians in community settings to determine the effects of specific services because outcomes, while interesting in the aggregate to researchers and decision-makers, are most valuable to librarians as indicators of their contributions. In addition, evaluation can provide the tools that enable librarians to shape services based on a better understanding of the impacts of present service models and activities. The research below, informed by the use of contextual approaches, shows how librarians can identify a rich group of indicators of impact.

## Emerging Research: Using Contextual Approaches to Determine Outcomes, The "How Libraries and Librarians Help" Study

Contextual approaches have provided information behavior researchers much richer ways to understand people's use of information. These approaches can provide both researchers and librarians with an approach that can be used to develop a rich set of outcomes. Data for this section were drawn from findings of a recently completed research study entitled "How Libraries and Librarians Help: Context-Centered Methods for Evaluating Public Library Efforts at Bridging the Digital Divide and Building Community." The study was funded by IMLS, and the research was conducted by a team of researchers from the University of Michigan and the University of Washington. Researchers applied contextual approaches to this important evaluation question. This research, using qualitative approaches, empirically examined the *use* of specific community-focused services to develop context-sensitive approaches and instruments that identify outcomes. Services included those designed for immigrant populations, after-school community technology programs for teens, community networks, information and referral services, programs designed around ethnicity, and consumer health information services. Together these case studies: 1. contribute to the growing knowledge base that shows how library services affect lives, and 2. have resulted in the field's first set of contextual tools designed to identify outcomes of public library services.[7]

The "How Libraries and Librarians Help" study was built on the large body of information behavior research (cf. Pettigrew et al., 2001; Wilson, 1997; Dervin, 1992), and on research on people's use of everyday information (e.g., Harris & Dewdney, 1994; Savolainen, 1995). The contextual frame, drawn from the past research of the principal investigators and the frameworks of others, incorporates factors associated with the clientele as well as library-centered factors and those associated with staff (Pettigrew,

1999; Durrance, 1993; Durrance, 1994; Durrance & Pettigrew, 2001; Pettigrew et al., 1999). Research that we have conducted has been discussed extensively in other articles (Durrance & Pettigrew, 2000, 2001, 2002; Durrance & Fisher-Pettigrew, 2002; Pettigrew, Durrance, & Unruh, in press). The specific framework employed varied among the sites, but in general incorporated the following factors:

*The clientele of the specific service.* The individuals who participated in this study of community-focused services differed considerably. They were the study's primary informants. Researchers spoke to individuals and representatives of organizations who used or could use a particular service. Interviews focused on their needs and their experiences. Teens in the community technology programs came to gain technology skills and left with considerably more than that. Often, however, they indicated that they needed to overcome negative perceptions of librarians in order to be able to reap the benefits of the programs they participated in. Community agency staff and community nonprofits were almost worshipful of library staff who had over the years helped them better understand and participate in the community as information providers. All shared a concern that information was difficult for them to get and use. Immigrants in the study often spoke no English at all and required the assistance of staff who spoke their language or a language that they understood other than English. Because of these difficulties, most of the interviews with this population were conducted by library staff in their own language and not by project researchers.

*The library and its service model.* This research focused on a range of problem areas undertaken by public libraries: the problems faced by immigrant populations, the need to help bridge the digital divide for teens in poor communities, the need to meet community information needs, the need for multicultural opportunities, people's need for health information, and building electronic community. All had in common a community-focused model. However, each model is specific to the needs identified in the community. Data were collected by examining materials developed by the library, interviewing administrators and staff, and extrapolating model components from interviews with users of the model.

*The set of activities designed to respond to the clientele.* This research identified a varied set of activities that reflected a rich knowledge of the chosen primary clientele. Although the manifestations were different in each service, each of these community-focused services provided a warm, welcoming environment that fostered the activities associated with the service. Activities vary from providing what is perceived by users as a safe place to a variety of proactive approaches to increasing access to information.

*Staff contributions.* Each of these programs was headed by visionary staff who shaped the model, recruited the clientele, and developed the activities that shaped the outcomes of this community-focused service. Staff shared these characteristics: they were committed to their clientele, creative in their

approach to providing service, entrepreneurial in their approaches to seeking additional resources, and were able to articulate some, but not all, of the outcomes of their services. Some were recruited to their jobs because of special skills that they brought to the service such as language facility, interest in the clientele, ability to teach, or knowledge of information technology.

The section below presents descriptions of three types of library programs in four libraries (the second program example examines two different approaches to presenting after-school community technology programs for children and teens). For all four case studies, we present the setting, the program, and what we consider "candidate outcomes," that have emerged from examining the contextual factors identified above.[8] At present, these are presented as candidate outcomes which will be further honed and tested by the study libraries. They are framed from the perspective of the users of the service.

In each case study, the *italicized terms* in the discussions of candidate outcomes represent major outcome categories. The case studies from which these data were drawn include, as well, a range of indicators of impact consisting of anecdotal data and specific comments from users that reflect the outcome. Headings are taken from site-specific codebooks developed in the course of analyzing the qualitative data collected as part of the investigation.

The contextual factors, as will be seen in the discussion below, result in services which have both similar and unique qualities. In addition, each service has a unique set of stakeholders (including the participants, interested agencies and organizations, and decision-makers within and outside of the library) who need to understand the impacts of the service. While the candidate outcomes presented here were identified by the study research team, they have not yet been tested. The next step in the outcome selection process will be for staff (and stakeholders) at each participating (case study) library to select and test the outcomes they seek to use from the candidate set.

*Services to Immigrants by the Queens Borough (NY) Public Library*

*Queens.* The 2000 census calculates the population of the Queens borough of New York City at 2.2 million, a 40 percent increase over 1990 statistics; 41.1 percent of the Queens population claim birth outside the United States, and, for the first time in the borough's history, more than half of Queens residents speak a language other than English. The 2000 census records a 50 percent increase in the Hispanic population, bringing the Hispanic community to account for a quarter of the borough population. In addition, African Americans make up 19 percent of Queens residents, while Asians constitute 17 percent. The borough also boasts the highest populations of a number of ethnic groups in the city, among them Asian Indian, Chinese, Korean, Filipino, Bangladeshi, Pakistani, and Colombian communities.

*Queens Borough Public Library (QBPL) Service Model and Activities.* Queens Borough Public Library (QBPL), a system with sixty-three branches and six Adult Learner Centers, serves the most ethnically diverse county in the United States. Queens customers represent over 120 countries and 160 nationalities, and speak over 100 languages. To ensure that branch programs and services appropriately reflect local constituencies, QBPL employs a full-time demographer to analyze data from multiple sources. The demographer also produces color-coded maps of Queens' communities using Geographic Information System (GIS) software. Demographic analysis and visualization allows the Queens Borough Public Library to take a current snapshot of the community, as well as to project future demographic shifts. The library's New Americans Program seeks to help to transition immigrants into American life. It encompasses multilingual Web site management; multilingual, multicultural, and multimedia collection development; mail-a-book programs in six to seven languages; and two streams of public programming: cultural arts programs and coping skills workshops. Staged throughout the borough, the library's cultural arts programs celebrate a variety of cultures in multiple languages. Queens' coping skills workshops address topics in response to the needs of Queens' immigrant populations. The library hosts coping skills workshops in Spanish, Chinese, Korean, and Russian, but, as warranted, the library extends this programming to include other languages, including Haitian, Creole, Polish, Hindi, and Bengali. The Adult Learner Program of the Queens Public Library, also designed to meet the needs of immigrants, serves over 6,000 students a year in tailored settings. In addition to its specialized curricula, the program supports small group classes, conversation groups, and technology-assisted instruction. Its English for Speakers of Other Languages (ESOL) Program offers ninety-two classes in two terms per year in locations throughout the borough. These classes are always oversubscribed and are on a first-come, first-served basis.

*Candidate Outcomes for Immigrants.* The QBPL services demonstrate the range of outcomes that librarians can expect from library services designed to reach and to serve immigrant communities. Outcomes of the program, and their indicators of impact, are reflected as changes in skills and abilities, perceptions and attitudes, and changes in behavior. The following *italicized* indicators of outcome show how immigrants and their families benefit from the New Americans and Adult Learner Programs offered at QBPL. Outcomes originate with *immigrants' discovery of the library* and in their appreciation of its role as a safe and welcoming place through which to adapt to their new environment. Once in the library, immigrants begin to build information literacy skills as they learn what the library can do for them and how to exploit its resources. Their transition further advances as *immigrants effectively interact with staff,* interactions—often in the immigrants' native tongues—that support relationship-building and thus help to integrate the immigrant into the social fabric of the community. In turn, *immigrants bridge*

*cultural landscapes* as the library allows them to maintain connections to their native culture, introduces them to foreign cultures, and links them to their new American culture and community. Once equipped with an appreciation of resources and of context, *immigrants gain new skills and knowledge* that allow them to become more independent as they seek to improve their lives and the lives of their families. In the process, immigrants develop a positive impression of the library and share news of their experience with family and friends, returning benefits to the library itself.

*After-School Public Library Community Technology Programs in Austin, TX, and Flint, MI*

Two case studies focused on community technology programs. The service model and clientele varied considerably; these variations influenced the outcomes experienced by participants.

*Austin.* The mission of the Austin Public Library is "to provide open access to information and to promote literacy, love of reading, and lifelong learning opportunities for all members of the community." Wired for Youth (WFY) is an after-school drop-in program aimed at providing computers to youth in or near low-income areas in selected library branches. The goal of the program is to provide facilitated Internet and computer access to Austin youth, in particular those at-risk. WFY is a nonstructured computer technology program for young teens and preteens based on computer self-use. The WFY computers, located in public spaces in branch libraries, are designated for youth use, only. Computers are loaded with kid-friendly educational software and Internet sites and computer games. They are available on a first-come, first-served basis and use is generally limited to thirty minutes due to heavy demand.

WFY librarians provide basic technology skills, use technology as a tool to help make students feel comfortable in the library, make the library a warm, inviting place, and provide a place for homework and access to tutoring assistance in most branches. Each librarian acts as a facilitator, a reference librarian, and an educator (primarily for one-on-one, as-needed instruction). WFY librarians help students configure e-mail accounts and enroll in virtual pen pal programs with kids in other countries, conduct selected training sessions, showcase student work, engage in a variety of trust-building activities, and help students complete small tasks with attainable goals on the computer. WFY staff "triage" children coming through the door after school, directing them to various activities, and developing activities for students who are waiting for computers.

*Flint.* Flint, MI, is a rust-belt community that has experienced economic downturns in recent decades, including the exit of the city's major employer, General Motors. The city and school system struggle with scarce resources because of the declining tax base. The city is about 53 percent African American, 41 percent white. Community Information Agents Online

(CIAO), an intensive after-school community technology program requiring five to six hours per week for the school year, sought to foster teen civic engagement by giving the teen participants the skills they needed to help a community organization as it developed a Web presence. Thus, students needed to increase both their knowledge of the community and develop a range of technology skills. To do this, participants were required to spend one afternoon a week and a Saturday morning engaged in active learning and site development.

By the end of the program (an academic year), teenagers had adopted an array of computing technologies to support their project work. Hardware, like digital cameras and scanners, and software, including word processors, graphics editors, browsers, and Web page editors, were among the tools the teenagers used each session. Students were expected to gain the skills needed to develop the content for a Web site by working with a community organization to interview staff and edit content based on staff input. The program focused on positive aspects of their community and encouraged students to learn more about their community and seek out community assets. Flint Public Library staff held periodic public celebrations designed to foster pride, self-confidence, and presentation skills of the participants as well as to have them exhibit their work. Students and staff invited parents, nonprofit organizations, local community leaders, and the local news media, including the local television station, to these events that were always accompanied by refreshments. Students had opportunities to present their work briefly to the entire group and demonstrate it at one of the computer stations in the lab.

*Candidate Outcomes for Youth.* This study of after-school community technology programs in Flint and Austin shows that such public library programs can have strong impacts on the young people who use them that go well beyond the technology skills the participants initially seek. Given the differences in the models and the fact that in determining program impact a one-size-fits-all approach does not apply, outcomes are similar, but not the same. They may vary both in kind and intensity while the overall framework may be similar.

*Austin Candidate Outcomes.* WFY Centers have become a *"safe place" for kids* after school, and many stay until the library closes. Youth interviewed at the library told us how much they valued the library as a safe, welcoming place where they could do homework, work and play on the computers, and work with others. Youth reported that they had increased their *technology skills.* Participating in WFY has given Austin children the opportunity to *increase their communication and self-expression skills,* and has *fostered their ability to learn. Perception and attitude changes* such as increasing trust of library staff are also important outcomes of this program. For kids who have negative perceptions of adults in their lives, *changed perceptions* are necessary before they can trust an adult. WFY librarians noticed that over time the

program *helped build the confidence* of some children and *broaden children's world-view.* This research showed that some *benefits extend beyond the participant* to families and friends.

*Flint Candidate Outcomes.* The teens that participated in the community technology program in Flint gained an extensive range of *technology skills.* Gaining these skills provided these teens with a personal cache and recognition. Likewise they developed *communication skills,* including the ability to express themselves and to communicate more effectively with people they didn't know well. Flint CIAO participants made a variety of *learning gains.* Participants became *actively engaged in their own learning and gained knowledge of their community.* Building on the previous gains it appears that *some participants became more actively engaged.* CIAO staff and participants both noted *changes in participant perceptions and attitudes.* Leaders noticed increasing youth trust in staff. Participants, in addition, developed a *sense of responsibility* for their work and showed pride in their accomplishments. Participants and staff noted changes in their *social behavior and building social capital.* These changes can be seen in new social patterns of engagement, relationship-building, and expanding social networks. Participants valued the networks of the librarians in the community. The fact that students were associated with the library opened doors to community organizations generally closed to teenagers. Finally, a group of *family and community outcomes,* including sharing of knowledge gains with family members, teachers, and others, appear to extend beyond the teens to their families and neighborhoods.

*Peninsula Library System's Community Information Program Information and Referral Service*

*The Community Information Program Model.* The Peninsula Library System (PLS), headquartered in San Mateo, CA, is a consortium of thirty-four public and community college libraries that serve multiple communities in the area. Its mission states that PLS "strengthens local libraries through cooperation, enabling them to provide better service to their diverse communities." PLS's twenty-five-year-old Community Information Program (CIP) seeks to provide accurate and up-to-date information to social service agencies and library staff through its database and a variety of publications. The database contains over 3,000 detailed profiles and contact information for nonprofit and government agencies in the county that provide direct services to the public. CIP's primary clientele are the social service agencies who use either the database or the many specialized publications and services, such as customized map development, developed by CIP staff. Relationships with the clientele have developed over time and agencies indicate that CIP provides them with both community information and the ability to disseminate information about their own agency's activities to potential clientele. CIP is staffed by a group of librarians who work for the Peninsula Library System, but are housed with other county

human service agencies, providing the benefits of proximity between staff and clientele. CIP staff focus both on database development and maintaining contact with their clientele; they work collaboratively with many community organizations. Staff skills include: public speaking skills and training abilities; some staff have gained skills in the use of special purpose software such as geographic information systems (GIS). In addition to providing products and services directly related to the database, CIP has taken a leadership role as an information provider within the nonprofit community. CIP hosts regular meetings for service providers to meet and exchange ideas and regular training sessions to orient nonprofit staff to community resources.

*Candidate Outcomes for Community Organizations.* A synergistic cycle of community outcomes appears to result from the carefully crafted strategies and activities devised by CIP starting with the solid framework which rests on the CIP community information database. The reliable and up-to-date information provided by the CIP and the connections that the program makes between community organizations lead to larger outcomes. The research team identified six categories of impact on area human services organizations, starting with the most basic—*increased knowledge of the community.* This gain is the direct result of a variety of information products that result from the major CIP database. Secondly, CIP staff foster *shared information and increased communication.* Information-sharing and its corollary, increased communication among organizations, are fostered through a variety of CIP outreach mechanisms such as orientation sessions and bimonthly meetings. These and additional organization development activities, in turn, lead to the third group of outcomes, *increased coordination and collaboration* among the target organizations in the community. It is not surprising that the fourth and fifth categories—*increased organizational capacity* and the resulting *improved delivery of services*—show a synergy that builds on the more basic strategies, and, of course, the resulting outcomes. Finally, it appears that these outcomes lead to a community-wide set of impacts; by employing a set of diverse strategies, CIP lays the foundation for a *more effective community.*

## Further Research: Toward Context-Sensitive Outcomes

Contextual approaches based on qualitative studies, as we have seen above, produce rich outcomes. The outcomes discussed above represent only some of those identified through this IMLS-funded research. A theme that crossed case studies showed that librarians act to *bridge the digital divide and increase technological literacy,* and in addition facilitate a variety of *personal efficacy and affective outcomes,* including general life improvements, confidence-building, a changed outlook on life and future prospects, feelings of accomplishment and hope, and changes in the use of time and resources.

In addition to the community-focused outcomes explored above, we have found that community networks bring similar *empowering benefits for organizations* that reach and serve a variety of audiences (Durrance & Pettigrew, 2001; Durrance & Fisher-Pettigrew, 2002). Other studies have shown that many libraries contribute *job-related benefits* to citizens (Durrance, 1993, 1994). The recent book *Libraries and Democracy* focuses extensively on the roles that libraries and librarians play in a civil society including identifying examples that show how libraries contribute to *increased civic participation and changes in social and community connections* (Kranich, 2001). The Counting on Results study, based on librarian-suggested outcomes, identified some viable outcomes of public library service responses (Steffen et al., 2002; Steffen & Lance, 2002; Lance et al., 2002).

The initial work done in this area has only begun to identify outcomes that reflect the contributions of public libraries. Most of the impacts of public library services remain largely undocumented, and research that focuses on the differences that libraries and librarians make in their communities is at the stage that research on the reference interaction was in the early 1970s. At the beginning stages of research on reference, no one could have predicted how it would build on itself, resulting in the rich and varied contributions that research has made to understanding that seemingly simple interaction. Had some external factor frozen this research on the reference interaction at that time, researchers and the profession would not have the rich knowledge base that has built up over the past thirty years. However, pressures for immediate accountability, discussed early in this article, do exist; these accountability pressures and the need to codify outcomes could serve to limit the move toward further identification of impacts that will make sense to citizens, policy-makers, and social science researchers. Decision-makers must resist a rush to develop a comprehensive "set" of outcomes that can be tested across libraries and instead focus on helping librarians more effectively identify and articulate both their value and the contributions of the institution. This of course will also mean testing candidate outcomes that will reflect the contextual factors of importance to specific services at the local level. Likewise, librarians must immediately take action to understand the new evaluation environment and the value of determining the outcomes of their services.[9]

Researchers and librarians will need to work together to articulate the outcome patterns that occur across services and to assist in the important definition and conceptual development likely to occur as librarians' acceptance and use of this approach to evaluation grows. Academic librarians seeking to determine the impact of library services and information literacy approaches have already begun to move into this stage of development. Public library researchers and librarians should be prepared to move into a period of "develop[ing] definitions and concepts that support more effective communication and use" of outcomes such as described by Kyrilli-

dou (2002). This period will be followed by more research aimed at identifying relevant outcomes that actually build on previous work; this will likely be followed, as Kyrillidou suggests, by definition tightening, testing, and honing data collection approaches. It is difficult at this stage to predict the trajectory of this research. If it is shaped by external frameworks that speak to decision-makers, government agencies, researchers, and citizens as discussed in the article's opening paragraphs, there is more chance the research will provide librarians with the tools they need to determine and articulate their contributions and those of libraries.

## NOTES

1. For more information about this research, see: http://www.si.umich.edu/libhelp/.
2. The coauthor of this paper has also published under the name of Karen E. Pettigrew.
3. Evanston Public Library. http://www.evanston.lib.il.us/library/mission-statement.html.
4. Boulder Public Library. http://www.boulder.lib.co.us/general/annual/1999/mission.html.
5. Los Angeles Public Library. http://inside.lapl.org/manuals/StrategicPlan.pdf.
6. See: http://www.sztaki.hu/conferences/deval/.
7. These tools, entitled *Putting outcome evaluation in context: A toolkit,* can be found on the Internet. See: http://www.si.umich.edu/libhelp/toolkit/index.html.
8. See http://www.si.umich.edu/libhelp/ for additional case studies, methodological approaches, and related articles.
9. *Putting outcome evaluation in context: A toolkit,* http://www.si.umich.edu/libhelp/toolkit/index.html, provides an introduction to outcome evaluation as well as a multistep approach to identifying outcomes in a particular setting using contextual approaches.

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# Public Library Service to Children and Teens: A Research Agenda

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## ABSTRACT

THIS PAPER DEALS WITH FOUR SIGNIFICANT UNANSWERED QUESTIONS related to children's and young adult services in public libraries: 1. How have public library services to children and young adults developed over time? 2. How and why do young people use public libraries? 3. How can we evaluate the effectiveness of public library service for young people? 4. Why should policymakers fund public library services for children and young adults? After reviewing the existing knowledge base that can serve as scaffolding for the needed research, the author suggests strategies for refining and implementing this research agenda.

## INTRODUCTION

On a typical day in a typical midsized public library, up to 60 percent of its users will be under the age of eighteen. Toddlers come for storytimes. Teachers and day care providers bring groups of children to find books and information, to be instructed in information literacy skills, and to hear stories. Schoolchildren drop in for after-school programming or homework assistance. They browse the shelves and participate in book discussion groups. Children of all ages cluster around the computer workstations where they look for information about their current sports and music idols as well as for materials for school reports. They play games, do e-mail, and chat with friends from school and around the world. Teens show up to see and be seen, to check out CDs and magazines, and to do their homework. They advise library staff on collection development and services; they also provide some of those services as paid workers or volunteers. Even babies

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 571–589

are now legitimate library users in their own right, not just cargo for parents and caregivers who must bring the little ones along on their library visits. Infants have their own story programs and library materials—lapsits and board books. Their parents may attend educational sessions that disseminate the latest research findings about early childhood literacy and instruct them in techniques for encouraging the reading skills in their own preschool children.

A surprising amount of this activity remains unexamined by the research community. Children's and young adult librarians, while they are often reflective practitioners, are usually too busy to conduct research studies themselves, and academics have often found children to be less interesting or somehow less legitimate subjects than adults. There are, therefore, many gaps in what we know about library services to people in their first two decades of life. This paper identifies four significant unanswered research questions related to children's and young library services. It outlines the existing knowledge base that can serve as scaffolding for the needed research and suggests strategies for implementing this research agenda.

## The Big Four: Questions Needing Answers

The major gaps in research about public library services for children and young adults can be summarized as four questions:

- How have public library services to children and young adults developed over the years?
- How and why do young people use public libraries?
- How can we evaluate the effectiveness of public library service for young people?
- Why should policymakers fund public library services for children and young adults?

Note that these questions fall into four traditional areas of scholarship: historical research, user studies, evaluation research, and policy studies. The sections that follow provide a brief rationale for the significance of each of the four major research questions and an overview of the theoretical and empirical foundations on which to build the scaffolding for continuing scholarship.

## Historical Research: How Have Public Library Services to Children and Young Adults Developed over the Years?

Public library service to children began a little more than 100 years ago. It was created by a small band of determined women who persisted in spite of the opposition or lack of interest of many of the most influential library leaders of the time. The record of their achievements has considerable relevance today as we try to redefine the role of public libraries in the lives

of children in a vastly changed society. What can we learn from the past that can inform our future?

A single historical study of the genesis and development of library services for children has not yet been written. However, Christine Jenkins (1994, 1996) and Anne Lundin (1996, 1998) have contributed important pieces of feminist scholarship about the women whose leadership was so critical in the early years. Walter (2001) relied on Jenkins and Lundin as well as other documentation and primary sources for the first chapter of *Children and Libraries: Getting It Right* (2001) in which she traces the historical roots that influence the library services of today. The writings of influential early children's library leaders such as Anne Carroll Moore (1969) and Frances Clarke Sayers (1965) are sources from which we can tease out the philosophy and values that guided the emergence of the field.

It is sometimes necessary to look beyond the books and articles devoted to children's services in order to ferret out important scholarship relevant to the field. Abigail A. Van Slyck's study of Carnegie libraries, *Free to All: Carnegie Libraries and American Culture, 1890–1920* (1995), for example, offers fascinating insight on the interplay between space and the services provided for children in libraries. General histories of public libraries such as *Civic Space/cyberspace? The American Public Library in the Information Age* by Redmond Kathleen Molz and Phyllis Dain (1999) help to contextualize the role of children's services in the parent institution.

Unfortunately, whole decades of public library service to children remain undocumented except through scattered journalistic accounts in the popular library press. While we have fairly good documentation of the early years, we know much less about the period of diffusion in which children's services became institutionalized in public libraries of all sizes throughout the U.S. What happened to children's services during World Wars I and II? How did public libraries respond to the changes in children's lives caused by Sputnik and introduction of television? What were the contributions of extraordinary African-American children's library leaders, such as Augusta Baker, Effie Lee Morris, and Charlemae Rollins? What was the impact of the War on Poverty and the outreach movement on library services to children? How have libraries served immigrant children over time?

Library service for young adults is even more lacking in rigorous historical analysis and documentation. As with children's services, one can deduce the ideas that were held in good currency at various times by reading the words of leaders in the field. Perhaps the most influential is Margaret A. Edwards whose treatise on library services to teens, *The Fair Garden and the Swarm of Beasts; The Library and the Young Adult* (1969) was revised and reprinted in 1974 and again with a new foreword by Patty Campbell in 1994.

There is one exemplary historical study of young adult services. Miriam Braverman (1979) researched the early years of young adult library services in three urban settings—Cleveland, New York, and Baltimore. Her mono-

graph, *Youth, Society, and the Public Library,* is a fascinating chronicle of what seems to have been a golden age in young adult services in the 1930s and 1940s. The book also contributes to our understanding of the dimensions of leadership, politics, and economics in public library service innovations.

What is largely missing from the history of young adult services is an understanding of its development since the 1940s. Why did public libraries apparently retreat from targeting high school students at precisely the moment in American history when teenagers were being defined? Why was there an apparent resurgence of interest in young adult services within the American Library Association in the mid-1980s? What is the significance of contributions of more recent young adult advocates and spokespeople such as Mary Kay Chelton, Elaine Meyers, Patrick Jones, and Deborah Taylor?

## User Studies: How and Why do Young People Use Public Libraries?

Most studies show that as many as 50 to 60 percent of all public library users are young people. In a 1995 survey by the National Center for Educational Statistics, for example, librarians estimated that 35 percent of their users were children under eleven years of age, while 23 percent were twelve- to eighteen-year-olds (U.S. Department of Education, 1995). However, we have limited data about what those young people were doing at the library. The 1995 survey indicated that as many as 86 percent of the libraries responding offered programs for preschool and kindergarten children while 79 percent had programs for school-age children. Almost all librarians reported that they provide reference services to young people, while only one in seven offered homework assistance.

National data-gathering efforts such as the one summarized above use broad brush strokes to paint the landscape of library services to children and teenagers. What they fail to do is give us a finer-grained picture and deeper understanding of exactly how and why young people of different ages use the public library.

### *Marketing Studies*

Commercial organizations rely on marketing studies to learn about their current and potential customers. To some degree, public libraries do the same through environmental scans and community analyses conducted as part of their strategic planning efforts. Few of these local studies are ever published, however, and even fewer give any particular attention to children and teens. The few marketing studies that are available offer some interesting insights.

Walter and Markey (1997) conducted an action research study of the parent perceptions of the traditional summer reading program provided by the Los Angeles County Library. The analysis of data from parent surveys and focus groups indicated that it was the parents who are already high-

ly involved with their children's care and education who choose to enroll their children in the reading program. These parents see the benefits of the reading program as being primarily educational. Parents who do not register their children in the reading program cited three reasons: their own discomfort with a program that seems to foster competitiveness about reading, lack of time or bad timing, and perceived lack of needs. As a direct consequence of this study, the library made some changes in the way it designed and marketed the program in future years.

Before the Wallace-Reader's Digest Fund launched the Public Libraries as Partners in Youth Development (PLPYD) demonstration project, it commissioned a marketing study to determine what teens think about the public library. What the data gatherers learned from talking to teens in ten communities around the country is instructive. Teens said that libraries are not cool; the library staff is not helpful or friendly; their service hours are inconvenient. They wanted more welcoming space, more access to higher-end technology, more help with their homework, and better books and magazines. They wanted less restrictive rules and fees. And most importantly, they claimed that they could help libraries become better places for teens (Meyers, 1999).

The nine libraries that ultimately participated in the PLPYD developed new services and ongoing programs for teens based on the findings of this marketing study and on basic principles of youth development. They used a variety of strategies to support basic adolescent developmental outcomes while striving to be "cool." The Washoe County Library in Nevada developed Teen Action Teams that provide outreach services to children in low-income neighborhoods. Teens at the Public Library of Charlotte and Mecklenburg County in North Carolina operate a computer design and copy store at the library. Oakland Public Library in California is one of several locations that developed a teen employment program; their teens serve as homework helpers to younger children. In King County, Washington, Techno Teens are paid to assist patrons with the library's computer systems (Urban Libraries Council, 2002). The point here is that these programs were not created out of thin air; they were based on marketing research and sound principles of youth development. This kind of theory and research base could reasonably inform other aspects of library service to children and young adults.

*Information-Seeking Behavior of Children and Young Adults*

The scholarly domain that has contributed the most to our foundational knowledge about young people's library use is the field of information-seeking behavior, a broad area of study encompassing the identification of information needs, the ways in which people seek or search for information to meet those needs, the resources that meet those needs, and the ways in which people use the information after they have found it. The only

subtopic within this area to have yielded a significant body of cumulative research relevant to children and teenagers deals with the ways in which young people search for information in electronic resources. This research will be discussed in some detail later.

Much less attention has been given to other aspects of young people's information-seeking behavior. The resulting body of knowledge is therefore somewhat asymmetrical and fragmented. There is one interesting study on the cognitive utilization of heroin information by teenage girls in Australia (Todd, 1999). There are two studies related to various aspects of career information for teens (Julien, 1999; Poston-Anderson, 1993). There is surprisingly little research on the information needs of children and young adults, although that is presumably the stimulus that instigates the information-seeking process. The following section looks more closely at the small body of knowledge in this area.

*Research on the Information Needs of Children and Young Adults*

Walter's (1994) research on the information needs of children remains one of the few studies to look specifically at what children need to know and how they meet those needs. Beginning with the assumption that children's information needs are largely imposed on them by adults, she surveyed a broad range of key informants, adults who work with children in a variety of ways, from teachers and child care providers to recreation leaders, soccer coaches, and social workers. She found that children's information needs correspond to the hierarchy of needs identified by Abraham Maslow, with the adult informants identifying the most unmet needs at the lower levels—safety and physiological needs. The informants identified appropriate sources of information for children but felt that many of the potential information providers either lacked good resources themselves or the ability to communicate information effectively. As a result, too many children received a disproportionate amount of information—or misinformation—from the media and from peers.

Walter and Gross extended the general 1994 study with a more focused look at the domain of HIV/AIDS information for children. They developed a model of children's information needs about HIV/AIDS that takes into account both the child's developmental stage and the child's particular situation in relation to HIV/AIDS. Thus, a preschool child would not ordinarily need basic HIV/AIDS information. However, if the child has a friend or relative with AIDS or if the child is HIV-positive, then developmentally appropriate information about HIV/AIDS should be offered, preferably by the child's parents with health or child care providers and preschool teachers as secondary information providers. Children in the upper elementary grades, from the age of nine to eleven, on the other hand, all require basic HIV/AIDS information, with an emphasis on causes of AIDS, modes of transmission, and the value of social acceptance of people with AIDS (Walter & Gross, 1996).

The initial research on children's information needs described here needs to be extended to include children at different developmental stages and to other knowledge domains that are relevant to children. Many interesting questions arise. What are the information needs of two-year-olds? Are the information needs of an urban African-American eight-year-old girl different from those of an eight-year-old Swedish-American boy living on a farm in Minnesota? What are the information needs of children at different ages pertaining to civic or economic issues? What are the information needs of American children about children in other parts of the world?

*Research on Young People's Use of Electronic Resources*

The earliest research in this area focused on children's use of automated library catalogs. If adult library users had difficulties using these new tools, what problems might children have? Keyboarding and spelling proved to be the most obvious barriers, as Paul Solomon demonstrated in his dissertation research (Solomon, 1993).

A more extended study of children's online catalog use, the Science Library Catalog project, was conducted by researchers at UCLA in the early 1990s. Funded by the Sloan Foundation, this project was designed to discover how children search automated library catalogs. Children were tested on the Science Library Catalog, a prototype of an effective, child-friendly retrieval system for library catalog information, and on conventional online catalogs.

The fourth and sixth graders who participated in the study were able to use browsing modes and keyword systems quite successfully, showing great persistence in their search strategies. Search topics affected their success, however. The only topics that were consistently easy for the children to find were concrete subjects that were easy to spell, such as "chemistry" and "farming." The graphical user interface of the prototype Science Library Catalog helped children overcome some of the searching features that are difficult for children in typical keyword OPAC systems: typing skills, spelling, vocabulary, and Boolean logic. Topics that were located deeper in the Dewey hierarchy were easier to find on keyword systems. However, the focus group data from this study indicated that children would rather not use any library catalog at all; their preferred search strategy was to go directly to the shelves to find books, or to ask a friend or a librarian for help. The catalog is the search aid of last resort (Walter & Borgman, 1991; Borgman et al., 1995; Walter, Borgman, & Hirsh, 1996). The commercial product, Kid's Catalog, was built on some of the findings from the Science Library Catalog project (Busey & Doerr, 1993).

The introduction of the Internet into schools, public libraries, and private homes has been so rapid that it is difficult to accurately report how many young people now have access to this electronic resource. However, a recent national study funded by the Pew Charitable Trust estimated that at least 78 percent of all children between the ages of twelve and seventeen

regularly go online for school or personal use. A resounding 94 percent of these online kids report that they prefer to use the Internet over all other sources for school research. Thirty to forty percent of all teenagers can be considered "heavy Internet users."

The Pew study looked more closely at how this group of technically savvy teens use the Internet for school assignments. The students reported that the Internet enables them to juggle school assignments and extracurricular activities more efficiently. For the most part, they used the Internet as a virtual textbook and reference library. Some confessed to using the Internet as a shortcut, as a way to minimize their effort or even to cheat by plagiarizing material. These confident users also used the Internet as a way to collaborate on projects with their colleagues and as a "virtual locker, backpack, and notebook" where they could store their important school-related materials.

Many of the barriers reported by the young people in the Pew study are more relevant to schools than to public libraries, dealing with varying policies and educational strategies. They want higher-quality access to the Internet, fewer filtering restrictions, and more instruction in keyboarding, computer, and information literacy skills. However, one finding that has considerable relevance for public libraries is the students' insistence that the "digital divide" is a serious issue that creates subtle inequities among teenagers (Levin & Arafeh, 2002).

There have been several studies that look at the ways in which children and young people search for information on the Internet and in other electronic resources, such as online catalogs. The results are remarkably consistent.

The youngest children to be subjects in such a study are the seven-year-olds who participated in Linda Z. Cooper's investigation of the ways in which these beginning readers cope with textual information (2002). Using video cameras to record children's hand movements as they searched an online encyclopedia designed for the early elementary grades, in addition to field observations, the researcher found that emotional responses were important to the children's experience. These young children seemed to need the assurance of an adult in order to move through the research process. This is consistent with developmental theories such as Vygotsky's Zone of Proximal Development (1978) and with Carol Kuhlthau's research on the importance of affective states in the information-seeking process (1988, 1993).

Two studies point out the difficulty that elementary school children have evaluating the information they find on the Web (Kafai & Bates, 1997; Schacter, Chung, & Dorr, 1997). Sandra Hirsh's exploratory study of the relevance criteria used by a small group of fifth graders is helpful for understanding why children have problems with this element of information literacy. Her subjects came from a computer-rich environment with access to computers and the Internet at home as well as at their school and public

library. They were comfortable using a variety of platforms as sources for information.

When asked to talk about how they determined the usefulness of a document needed to fulfill a particular school assignment, the children in Hirsh's study listed four criteria: topicality, novelty, authority, and whether it appeared "interesting." The topicality criterion served to limit the time students spent with a particular information source; they scanned quickly to see if the data it contained matched up to a particular information need. Novelty was the criterion that helped them decide if a source told them anything new. Their ability to determine authority was often naïve, but they did understand that this was an important element in using information. They liked the electronic encyclopedia, for example, because they felt they could rely on the authority of its contents. Their desire for "interesting" materials often led them on tangents that hampered their searching efficiency (Hirsh, 1999).

Dania Bilal's research has focused on the use of the Yahooligans search engine by seventh graders looking for science information. Her methodology involved the capture of search strategies by Lotus ScreenCam and one-on-one interviews with the young people as they completed their search. She found that the more effective children used more systematic search strategies and relied less on looped searches and hyperlinks than their less successful peers (Bilal, 2000). When the search task was more complex and required critical thinking to determine the relevance of information and to construct new meaning from resources, these young people were often unable to apply existing domain knowledge to this effort. Bilal concluded that they were lacking the information literacy or research skills that would have enabled them to make the link between what they already knew and what they needed to discover (Bilal, 2001).

One study of the Web-searching behavior of older high school students invoked an interesting metaphor. "Searching the World Wide Web is like visiting a shopping mall the size of Seattle: Innumerable types of information, in a large variety of containers and in many different locations, are all available in one place" (Fidel et al., 1999, p. 24). The teens in this small study all had some experience using the computer and the Internet but had not received any formal training in Web searching. They proved to be very naïve about the information available on the Web, many thinking that it had been placed there by one mammoth clearinghouse, possibly Microsoft. They had little knowledge of search engines, evaluation criteria, or search strategies, relying on past experience and the assistance of their peers to locate new information. Yet, like the teens in the Pew study discussed earlier, they preferred the Internet to their school library as a source of information for homework; they liked its immediacy, convenience, and interactivity.

This relatively large body of research about children's interaction with electronic resources suggests several implications for public library practice.

It points out the need for increased and enhanced training in information literacy skills for all ages. While this is ordinarily considered the responsibility of school librarians working with classroom teachers, the evidence suggests that a more comprehensive approach is needed. Public libraries, particularly those offering after-school homework assistance programs, need to consider augmenting the training that young students get in school. They might also want to consider the importance of the adults who help young people find information in the library as supportive confidence builders as well as guides to the complex environment of online information. Public librarians are not ordinarily expected to be familiar with educational theory and research, but perhaps youth-serving staff need to understand principles such as Vygotsky's learning theories in order to be more effective mentors.

The research also suggests that more needs to be known about how librarians can build collections for young people using both print and electronic resources effectively. Academic libraries have looked extensively at this issue; however, it is hardly on the radar screens of children's and young adult librarians.

*Research on Use of Other Library Resources and Services by Children and Teens*

While scholars are increasingly doing research related to young people and their use of digital resources, they have rarely looked at other aspects of library use by young people. However, IMLS has just funded a three-year research project in which researchers from Drexel's College of Information Science and Technology will collaborate with staff from the Free Library of Philadelphia to investigate the everyday information seeking behavior of urban young adults (College of Information Science and Technology, 2002). Presumably this study will yield a broader picture of the ways in which teens use libraries.

The more general topic of public library reference service to children and teens has hardly been touched by the research community. Melissa Gross (1999, 2000) has contributed the model of "the imposed query," the question that is not self-generated but rather is imposed on the information-seeker by some external party. Children's homework assignments are an obvious example of the imposed query. Gross suggests that reference librarians need to restructure their approach to the reference interview when the patrons in front of them did not actually formulate the questions they are asking. Cindy Mediavilla (2001) is also building a good foundation of knowledge about homework assistance programs in public libraries.

Librarians continue to offer reference services to children, of course, in spite of the lack of research underpinnings. They also conduct summer reading programs, provide book discussion opportunities, market their services through flyers and personal visits to schools—all without much questioning of the value of these services or understanding of what best practices might be. It is likely that many good children's librarians are ac-

tually rethinking and refining services on the basis of clinical observations and the kind of "thinking in action" that Donald Schon (1983) finds pervasive in professional work. However, one area of children's library services is getting increased emphasis in the field and deserves special mention as a research gap. This is library service to preschool children and the important adults in their lives—parents and caregivers.

We have almost no good data about library services to very young children and their families and caregivers in spite of the fact that this is a growing element in public library services, with more and more public libraries entering the early childhood arena. A recent issue of *School Library Journal,* for example, featured a cover story on the emergent literacy initiative, "It's Never Too Early," that is being offered in all twenty-seven public library systems in the state of Maryland (Minkel, 2002, pp. 38–42). A sidebar points to other early childhood programs being offered by libraries in Chicago, Illinois; Cleveland, Ohio; Fort Wayne, Indiana; Hennepin County, Minnesota; and Pasadena, California.

We know that public libraries are providing more and more services to preschool children. The policy briefs by Walter and by Herb and Willough-by-Herb discussed later in this paper provide insight into the theoretical underpinnings for such services. Research from the fields of human development and cognitive science have alerted us to the importance of the early years to future educational success. Perhaps the most influential compilation of this research is the publication from the National Research Council, *Preventing Reading Difficulties in Young Children* (Snow et al., 1998). Lynne McKechnie (2000) notes that the conventional methods used in public library user research—interviews and surveys—are not appropriate for use with young children whose oral and written language skills are still developing. She proposes using ethnographic methods to discover what preschoolers do when they visit the library.

There is, therefore, a foundation to build on, or at least a framework for further research. We are just lacking the bricks and mortar, the studies that will help us understand how young children and the adults in their lives interact with library services. We need to know how choices are made about whether or not to make use of these library services. We still do not have evidence about the effectiveness of our early childhood interventions, what works and what does not. Therefore, we are uncertain about what comprises best practices in library service to very young children. We certainly do not know what difference these services make in their lives.

## Evaluation Research: How Can We Evaluate the Effectiveness of Public Library Services for Young People?

The original impetus for reliable evaluation tools for public library services came not from scholars but from elected officials. During the 1980s,

economic recession and taxpayer revolts resulted in serious budgetary shortfalls for local government throughout the country. Policymakers responded by requiring heads of public agencies, including libraries, to document their productivity and provide an accounting of the benefits of their services. Library directors were forced to look beyond their traditional circulation and reference counts for more reliable ways to describe and document their services.

The Public Library Association (PLA) responded to the need for more detailed and comprehensive measurement techniques with *Output Measures for Public Libraries* (Van House et al.,1987). The authors of this manual did not offer any specific measures for library service to young people other than those associated with the service role labeled "Preschoolers' Door to Learning." That gap was rectified by the publication of *Output Measures for Public Library Service to Children* (Walter, 1992) and *Output Measures and More: Planning and Evaluating Public Library Services for Young Adults* (Walter, 1995). The two follow-up manuals provided standardized procedures for collecting, interpreting, and using quantitative data to measure the outputs of library services for children and teens.

Unfortunately, the publication of the output measures manuals did not generate an outpouring of published research that would help to advance the knowledge base. It is likely that they were used to produce data for internal decision-making and budget justifications by individual library jurisdictions, however.

More recently, policymakers and funding sources have started to request a more sophisticated form of evaluation measures. No longer satisfied with the presentation of documented outputs, they are asking for *outcome* measures. Outputs are the quantifiable service products, such as numbers of books circulated or questions answered, the number of children attending storytimes, the number of young adults participating in volunteer efforts. Outcomes are the quantifiable results of those services. They attempt to measure the differences made to an individual as a result of checking out a book or attending a storytime or volunteering at the library.

A number of initiatives to develop usable outcome measures and measurement techniques for public library services in general are currently in progress. The Institute for Museum and Library Services (IMLS) has funded the Counting on Results project that aims to develop and test standardized tools for collecting outcome data from public library patrons. The principal investigators are basing their work on nine of the thirteen service responses included in the PLA *New Planning for Results* document (Nelson, 2001). Using postage-paid surveys, patrons are asked to respond to a series of statements about how the library's services had helped them (Steffan et al., 2002). While the early reports of the Counting on Results study appear to focus on adult services, there is potential here for data and methodologies that could be used for children as well.

There are at least three projects underway that are designed to yield outcome information about library services to young people. The IMLS-funded Project CATE (Children and Technology Evaluation) is a collaboration between staff at the Saint Louis Public Library and researchers from Florida State University. This study uses outcome measures to assess school-age children's use of technology at the library. So far, the project has yielded a model that will be tested in the next phase of research (Dresang et al., 2003).

A second important effort to develop outcome measures was funded by ALA through its Research Award that is administered by the Committee on Research and Statistics. Two UCLA researchers, Virginia Walter and Cindy Mediavilla, are developing measures that link the use of homework centers by teens to developmental outcomes. Their work should be disseminated in early 2003.

Finally, the PLA/ALSC Early Childhood Literacy task force is using outcome measures to test a research-based curriculum for training parents and child care providers in the most effective ways to develop the emergent literacy skills of the preschool children in their care. The results of a national pilot test are expected in early 2003 with a follow-up study commissioned for the following summer.

## Policy Studies: Why Should Policymakers Fund Public Library Services For Children and Young Adults?

Public libraries exist in a highly political environment, with most of their revenue coming from local government jurisdictions. It is surprising, therefore, that more policy studies have not been generated that address the role of the public library in supporting young people and families. The few studies that are produced tend to generate a lot of discussion and controversy. One such study is *Buildings, Books, and Bytes; Libraries and Communities in the Digital Age,* a publication of the Benton Foundation (Benton Foundation, 1996).

This study used key informant interviews, a public opinion survey, and one focus group to compare the public's preferences for public library services with the vision of public library leaders. The report states that library leaders envision the library of the future as a hybrid institution providing both digital and print resources with librarians helping patrons navigate the complex new world of information, while the public has a more conservative view. They hold libraries in high esteem, but place them on the fringes of modern life. They do not see libraries as leading the digital revolution, and they are unwilling to pay more for increased technological services.

Most worrisome to many readers of the report was the finding that the youngest Americans surveyed—those who are between eighteen and twenty-four—expressed the weakest support for the digital services of public libraries and for library buildings. Children's librarians may take heart, howev-

er, from the finding that the business of "providing reading hours and other programs for children" topped the rankings of library services; 83 percent of the survey participants rated it "very important" with another 12 percent rating it "moderately important." Approval ratings don't get much better than this.

The Benton Report was not received with complete approval within the library community, however. The entire summer, 1997, issue of *Library Trends* was devoted to responses to the report. Contributors to this issue were asked to "critique" the report, and critique it they did (Goldhor, 1997). Many of the writers had reservations about the methodology used to produce the report. Zweizig (1997) criticized it as naïve; Allen (1997) found the statistical analysis and subsequent interpretations to be faulty. Holt (1997) and McCook (1997) were particularly critical of the unrepresentative sample used in the focus group. And yet, almost all of the cities found that the report at least served the purpose of generating discussion, within the public library community if not in the broader policy arena.

As part of the PLPYD project discussed earlier, the funding agency commissioned the creation of a policy map that would clarify the public library's potential role in the landscape of youth development programs. Chapin Hall Center for Children, a social policy research institute at the University of Chicago, undertook this policy study. Some of their initial findings have been published in the library press (Costello et al., 2001). The researchers paint a normative picture of community agencies interlocking to create a web of primary supports for adolescents who need healthy relationships with other peers and with responsible, caring adults in order to make an effective transition from childhood to adulthood. They go on to ask whether or not libraries can be one of those agencies providing primary support for youth development. They find some barriers. Adolescent culture is not always compatible with library culture. Few public libraries have the kind of space that welcomes and nurtures teens. The needs of other patron groups are sometimes in conflict with the needs of young adults.

In spite of these obstacles, the Chapin Hall team find that some public libraries have been successful in developing effective strategies for engaging young people at risk. Initiatives that involved teens as technology assistants and homework helpers were promising. Some libraries have found creative ways to develop times and places that serve as havens for teens. Many public libraries have also developed mechanisms for meaningful participation by teens in planning and delivering young adult services. Finally, the Chapin Hall report encourages public libraries to partner with other community organizations and to do a better job of communicating their changing role to the public.

The Chapin Hall policy map meshes neatly with a recent report of the National Research Council, *Community Programs to Promote Youth Development* (Eccles & Goodman, 2002). This report documents the weakening of in-

formal community supports that were once available to young people in the United States. It urges a new direction in public policy that would place children and adolescents at the center of community life, where they can engage meaningfully with nurturing adults and develop the values, knowledge, and skills necessary to become healthy adults. The authors challenge organizations, including libraries, to design programs for youth that support this shift in policy. Both the rhetoric and the evidence presented in this report are convincing; it will be interesting to see if public libraries leverage the findings in meaningful ways.

Two policy briefs have outlined the library's role in early childhood education. One, by Steven Herb and Sara Willoughby-Herb (2001), presents the rationale for the library's claims to making contributions to helping to prepare young children for formal schooling. A second brief was commissioned by the Los Angeles County Department of Health to help inform policy-makers about emerging research in the area of emergent literacy. This document makes a strong case for the central role of the public library in helping very young children take the first steps to literacy (Walter, Armbruster, and Welsing, 2002).

One of the more troublesome policy issues for public libraries in the past decade has been in the area of Internet filtering for young people. It is clear that children's access to information has become much more problematical in the digital age. Whatever the final outcome of the legal challenges to the Children's Internet Protection Act, we will continue to need good policy studies that would untangle the competing claims for children's rights and children's protection as they relate to Internet filtering. Narrative policy analysis (Roe, 1994), a methodology developed to reconcile contentious and polarizing policy issues, is a promising approach to the problem. Perhaps the library community could look for opportunities to collaborate with other stakeholder organizations such as the Children's Partnership, the Children's Defense Fund, or the Electronic Frontier Foundation to produce research that would inform more rational policy responses than we have seen to date.

There are other gaps in the policy literature, of course. Some of the issues suited to further policy study include:

- The role of the public library as an educational resource for children and teens; and
- The role of the public library as a support for families.

## Setting and Implementing a National Research Agenda For Public Library Services to Children and Young Adults

This paper has presented a picture of peaks and valleys in the landscape of research about public library services to children and young adults. It is

a picture painted by one person with more than twenty years experience as a public library practitioner and more than twelve years as a library educator. Now it is time to expand the vision.

The profession—and ultimately the children and teens we serve—would be well-served by the creation of a national forum to discuss these issues. The American Library Association is a likely sponsor. The Institute for Museum and Library Services, as the major funding source for library research in the U.S., is a key stakeholder in such a forum. I propose a series of colloquia or institutes held throughout the country, bringing together the researchers and the librarians who are the ultimate consumers of their work and perhaps even the children and teens who presumably benefit from it. Participants in these regional gatherings would learn from each other; and out of that learning, the priorities for basic and applied research about the important interaction between libraries and young people would surely emerge.

It is encouraging that IMLS is funding relevant research and that prestigious scholarly journals are publishing it. It is also encouraging that with the possible funding of Laura Bush's initiative to recruit librarians, we have the prospect of increased funding for doctoral education in the field. As the research agenda grows, so does the need for scholars to do the research.

Many events of the recent past—from the attacks on the World Trade Center to the anthrax scare to the recent sniper activity in the Washington, D.C. area—have led to a feeling of unprecedented anxiety in the U.S. If ever parents and other adult caregivers needed supports within their community to help them respond to the concerns of the youngest Americans, it is now. If ever library directors and youth services librarians needed research-based knowledge to help them do their important job better, it is now.

This paper opened with a narrative about a typical day in a typical mid-sized public library, bustling with the activity generated by young users from infancy through adolescence. We know they are there, those eager young people in the first two decades of human life. Research could tell us so much more about why they have come to the library, what they are doing there, and what difference it will make in their lives.

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# Outcomes Assessment in the Networked Environment: Research Questions, Issues, Considerations, and Moving Forward

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## ABSTRACT

THIS ARTICLE IDENTIFIES A NUMBER OF RESEARCH TOPICS related broadly to outcomes assessment in a networked environment and discusses issues affecting these research topics. It also proposes a framework to relate traditional evaluation components and terminology to the networked environment and identifies a number of factors in the networked environment that affect outcomes and other assessment methods. The article suggests that outcomes assessment has the potential to complement other assessment techniques to better assist libraries and related information organizations enhance their decisions in the provision of information services and resources. Given the increased rate at which libraries are using the networked environment to provide services and resources, however, much work remains before most libraries can implement outcomes assessment efforts successfully.

## INTRODUCTION

Organizations of many types in various operating environments have used a variety of performance assessment activities for some time. Libraries are no different, having engaged in the use of output, service quality, performance indicator, balanced scorecard, and a number of other performance measurement techniques. At the core of these measurement activities are a number of basic questions:

- What resources are required to support the services that a library provides?

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 590–613

- What services and/or resources is a library able to provide with its investments in library infrastructure (broadly defined as personnel, technology, collections, facilities, etc.)?
- Are the library's customers receiving value out of the community's investment in library services?
- What is the real and/or perceived quality of library services?
- What are the impacts of library services and resources on the community that the library serves?
- What level of effort is required by library staff to implement measurement activities?
- In what ways does the library contribute to the overall mission, goals, and objectives of the community—or institutions within that community—the library serves?

The role and usefulness of outcome measures and outcomes assessment in answering these and related questions, although potentially rich, requires significant additional review, research, field testing, and development.

The purpose of this article is to:

- Identify selected research questions regarding outcomes assessment;
- Review a number of issues affecting outcomes assessment in general and outcomes assessment in a networked environment in particular; and
- Propose a framework to relate and better understand traditional evaluation components and terminology.

The article suggests that outcomes assessment has the potential to evolve to a point at which it will complement other assessment techniques that assist libraries and related information organizations make better decisions in the provision of information services and resources. There are, however, a number of research, methodological, and other issues that require consideration prior to reaching this potential. Given the library community's increased reliance on providing services and resources via the networked environment, much work lies ahead before libraries can engage successfully in outcomes assessment activities.

## Key Research Questions

Outcomes assessment is a relatively new activity to libraries, and as such, this is a very broad area for research. Indeed, as with any new area of scholarly endeavor, there are many more questions than answers. Some key research questions are:

- What are the prevailing models/approaches for library services/resources assessment?
- Are these models distinct or interrelated?
- To what degree do these models/approaches consider *networked* services/resources?

- How are "outcomes" considered in these various models?
- What do these models/approaches tell researchers and practitioners about use, uses, quality, impact, etc. of library services/resources?
- What outcomes assessment methods will be most useful and successful given the needs of a library, the resources available to the library for assessment, the assessment activity objectives, staff skills available, and other situational factors?
- What are the key variables to consider in the development of such models?

This article provides a foundation upon which to begin addressing these questions. The authors do not claim, however, that these are the only research questions that require attention regarding library outcomes assessment activities. These questions are, though, essential to further the development of outcomes assessment approaches that provide libraries with techniques that identify the impacts and benefits of library services/resources on the communities that they serve. The remainder of the article presents the issues and considerations regarding these research questions as a means of moving the research agenda forward.

*The Current Context and the Need for Answers*

The environment in which libraries find themselves at present creates a situation in which answers to the above posed research questions are essential. Libraries of all types, but public and academic libraries in particular, find that they are considered increasingly as part of the larger organizational structure in which they reside—university departments or local government agencies. As such, library funding and continued well-being is no longer distinct from that of any other campus or local agency. Because of this situation, libraries are being asked to:

- Articulate the importance of and need for their services and resources;
- Identify the use and uses of their services and resources; and
- Establish the value, impacts, and benefits that the community receives from the library services and resources.

Given the above circumstances, it behooves the library practitioner and research communities to have assessment tools and approaches that enable libraries to articulate their contribution to the well-being of the communities that they serve.

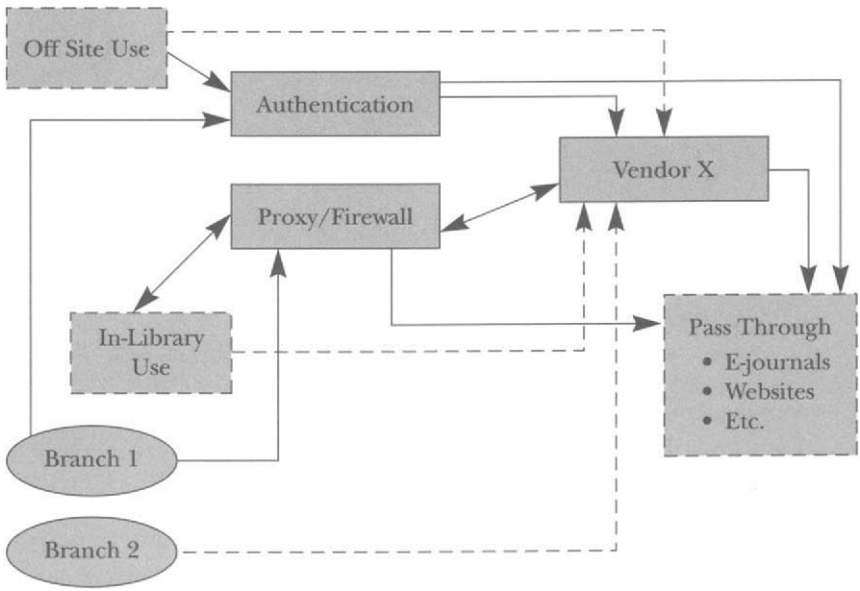
In addition to this management context, there is the evolving technology context in which libraries operate. To state the obvious, library services and resources rely increasingly on:

- Technologies that continue to change and evolve at an ever-intensifying pace. On the one hand, these technology changes enable new services and resources that allow libraries to better meet the service and

resource needs of their customers. On the other hand, this continual cycle of adoption, change, and new and/or enhanced services and resources creates a number of challenges—including assessment challenges—for libraries.

- Leased and network-based resources and situations that remain outside the direct control of libraries (see Figure 1). For example, libraries continue to grow their subscriptions to online databases and resources (e.g., e-books). Moreover, customer access to those services and resources can occur through a number of nonlibrary venues—each of which has implications for what libraries and vendors can collect and report regarding those user-initiated activities. As such, libraries are in a situation in which they do not control the services themselves (libraries are merely subscribers to resources such as EbscoHost, ScienceDirect, and NetLibrary), do not control the path through which customers gain access to the service/resource (remote access is beyond the scope of the library), and do not control the customer service/resource use and interaction data. All of this has a direct impact on the assessment activities in which a library can engage, the findings derived from such activities, and the types of questions that libraries can ask users regarding their use and/or assessment of the services/resources accessed (Shim & McClure, 2002).

*Figure 1.* User Initiation of an Online Database Session.




Dashed lines indicate direct access to vendor services without passing through an authentication and/or proxy server.

Added to this mix is the impression that some outside the library community regard the information content as available without charge to Internet users. As libraries struggle to identify, define, and articulate the impacts derived by customers through the use of library services and resources, libraries must educate the communities that they serve regarding the issues associated with networked-based information content.

There are a number of evaluation methodologies that exist—for example, return on investment, quality assessment, outcomes assessment, outputs, best practices—to assist libraries in identifying and communicating their service/resource impacts on their communities. There are also a number of situational factors that affect a library's or a researcher's ability to identify, study, and present results of that work. This article describes a selected number of those methodologies, explores the relationship between them, and presents issues associated with methods and what they can tell us about library services and resources.

## Understanding Outcomes

A first step in addressing the research questions posed earlier is defining and understanding an "outcome." There is no single concise definition of what an "outcome" means in the context of library service. During the past decade, a number of writers and researchers have proposed definitions that Table 1 summarizes. A review of various definitions, however, does yield a number of common elements. In general, outcomes:

- Include the notion of an impact, benefit, difference, or change in a user, group, or institution based on the use of or involvement with a library service or resource;
- Are predetermined based on a service/resource planning process in which the library engages to produce desired service/resource outcomes through the setting of service/resource goals and objectives; and
- Involve measuring and demonstrating the extent to which library services/resources meet the anticipated outcomes determined by the library or imposed by the community the library serves (e.g., academic institution, county, city).

These definitions broadly, therefore, consider outcomes assessment to be a proactive endeavor on the part of the library in which there is an *a priori* determination of the library service/resource preferred outcomes.

In general, these definitions assume that there is a larger context in which libraries reside that provides the basis for the library service/resource outcomes. In the case of academic libraries, for example, the desired outcomes might take the form of accreditation standards set forth by accreditation bodies; accountability measures imposed by university administrators/ boards; or state government–imposed higher education outcomes. Finally, these definitions assume that libraries are able to measure their

*Table 1.* Selected Definitions of Outcomes and Outcomes Assessment.*

| Citation | Definition of Outcome |
|---|---|
| Zweizig, D., Johnson, D., Robbins, J., & Besant, J. (1994). *TELL IT! Evaluation sourcebook and training manual.* Madison, WI: University of Wisconsin, Madison, School of Library and Information Studies. | "Outcomes—how things changed for the community" (p. 104). |
| United Way. (1996). *Measuring program outcomes: A practical approach.* Alexandria, VA: United Way. | "Outcomes are benefits for participants during or after their involvement with a program. Outcomes may relate to knowledge, skills, attitudes, values, behavior, condition, or status" (p. xv). |
| Himmel, E., & Wilson, W. J. (1998). *Planning for results: A public library transformation process: The how-to manual.* Chicago: American Library Association. | ". . . a service response is what a library does for, or offers to, the public in an effort to meet specific community needs. Service responses represent the gathering and deployment of critical resources to produce a specific public benefit or result" (p. 51–52). |
| Himmel, E., & Wilson, W. J. *Planning for results: A public library transformation process: The guidebook.* Chicago: American Library Association. | "Evaluation is the process used to measure the performance of a service against some pre-determined criterion to see how well or poorly the service has been performed" (p. 35). |
| Institute of Library and Museum Services. (2000). *Perspectives on outcome based evaluation for libraries and museums.* Washington, D.C.: Institute of Library and Museum Services. | Outcomes are "benefits or changes for individuals or populations during or after participating in program activities..." that are measured against predetermined criteria (p. 20). |
| Free Library of Philadelphia. (2000, November 30). *Free Library of Philadelphia: Performance management final report.* Philadelphia, PA: Price Waterhouse Coopers. | Outcomes are "the quality of things produced" as related to the goals set forth early in the project's development (E, p. 1). |
| Association of College and Research Libraries. (2000). *Standards for college libraries 2000 edition.* Chicago: American Library Association, *ACRL College Libraries Section Standards Committee.* Available at: http://www.ala.org/acrl/guides/college.html | Focus "on the achievement of outcomes that have been identified as desirable in the library's goals and objectives. It identifies performance measures, such as proficiencies, that indicate how well the library is doing what it has stated it wishes to do." |
| Bertot, J. C., McClure, C. R., & Ryan, J. (2001). *Statistics and performance measures for public library networked services.* Chicago: American Library Association. | "An outcome measure is explicitly tied to the libraries goals, objectives, and planning process. A good outcome measure provides data that tells a library manager if a specific library objective has been achieved" (p. 66). |
| Hernon, P., & Dugan, R. E. (2002). *An action plan for outcomes assessment in your library.* Chicago: American Library Association. | "Outcomes assessment deals with academic institutions providing evidence that they are meeting their educational mission. In the case of the library, outcomes focus on how library users changed as a result of their contact with the library and its resources, services, and programs" (p. 2). |
| Fraser, B. T., & McClure, C. R. (2002, forthcoming). Toward a framework for assessing library and institutional outcomes. *Portal: Libraries and the Academy,* 2(4), 505–528. | An outcome is a "clearly identified result or end product that occurs as a consequence of individual or combined activities from units of the institution. It is a preferred or desired state and ideally clarifies specific expectations of what should be products from the institution." |

* The authors wish to thank Lara Rudolph for her assistance in compiling the citations in this table.

service/resource outcomes with reliable and valid instruments and demonstrate subsequently that library service/resource outcomes contribute to the mission, goals, and objectives of the community that the library serves.

Over time, library researchers, managers, and others have developed a number of models to describe and relate inputs, outputs, service quality, outcomes, impacts, etc. Kyrillidou (2002) summarizes some of these approaches. There is no lack of proposed models to describe these evaluation components (e.g., Hernon, 2002, p. 55; Cook & Heath, 2001, p. 580; Dresang & Gross, 2001, p. 28). While some might suggest that the plethora of views, models, and definitions describe a healthy intellectual development in library/information services and resources evaluation, others—namely many practitioners—may not agree. Part of the issue is that each of these views, models, and evaluation approaches is presented individually without any review or consideration of the relationship between the key aspects of these models or perspectives.

Outcomes assessment, although not new to other organizations and sectors, is relatively new to libraries and focuses on determining the impact of a library's services and/or resources on its customers. In the broadest sense, outcomes assessment focuses on the extent to which a library's services and/or resources made a difference in the life of the library's individual, group, or institutional users (see Table 2). Writers and researchers, however, do not agree on what it means to measure outcomes.

Kyrillidou (2002) presents three models that depict the possible relationship between inputs, outputs, outcomes, and service quality. These models include a linear model, cyclic model, and spiral swirl (p. 44). Without empirical testing, Kyrillidou finds problems with all the models presented save the spiral swirl as it apparently can depict motion and a more flexible and dynamic process that intertwines inputs, outputs, outcomes, and service quality. Ultimately, Kyrillidou concludes that service quality is an outcome of library services and resources that exist through a library resource input and output process.

Hernon (2002) reaches a different conclusion, stating that service quality and satisfaction and outcomes assessment "truly stand out as central assessment concepts for librarianship. Inputs and outputs are important to institutions and accrediting bodies as measure of efficiency and crude measure of effectiveness" (p. 55). In Hernon's view, therefore, there is little to no relationship between inputs, outputs, service quality, and outcomes assessment—and libraries should focus on service quality and outcomes assessment techniques. King et al. (2002) take a different approach by linking types of measurement perspectives (library, user, organization, etc.) with specific types of measures—one of which is outcomes. The approaches shown in Table 2 are illustrative of recent writings, though historically many writers have offered models and approaches related to inputs, measures, service quality, and outcomes.

*Table 2.* Selected Outcome Models.*

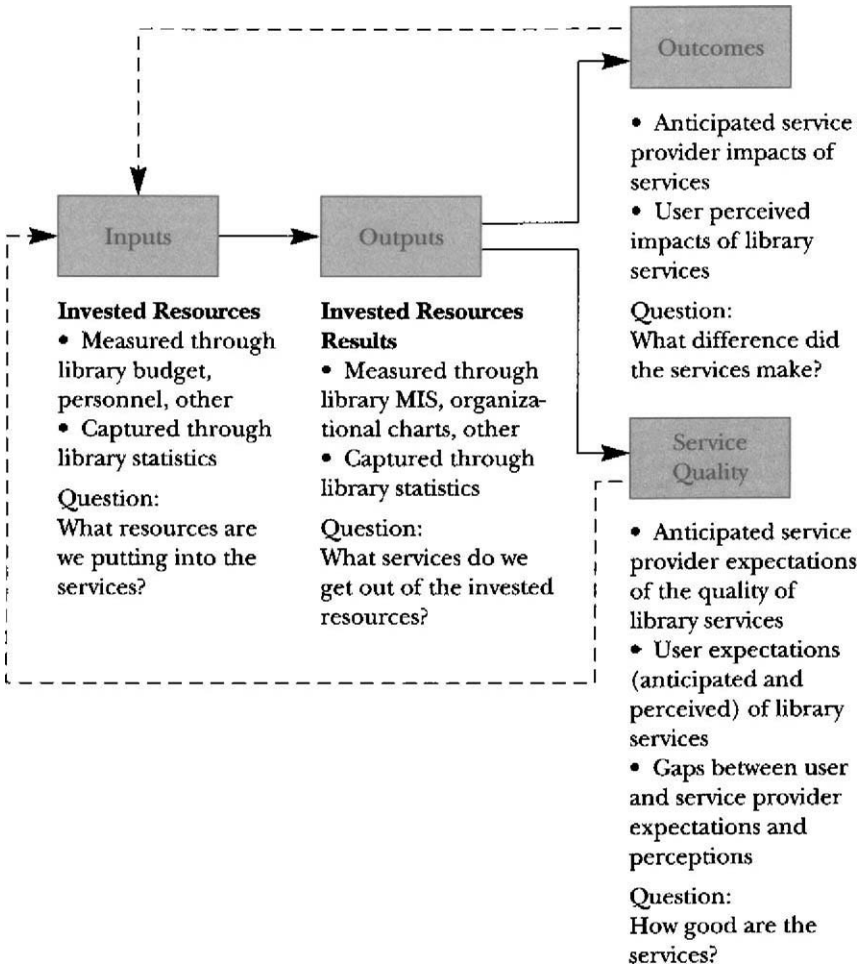
| Citation | Model | Summary |
|---|---|---|
| Kyrillidou, M. (2002). From input and output measures to quality and outcome measure, or, from the user in the life of the library to the library in the life of the user. *The Journal of Academic Librarianship, 28,* pp. 42–46. | The Linear Model | Based on the "assumption that inputs have a direct relation to outputs, which, in turn, relates to quality and outcomes" (p. 44). |
| | The Cyclic Model | Acknowledges that user transactions have "multiple dimensions of inputs, output, and quality and outcome elements from multiple interactive and reflective perspectives" (p. 44–45). |
| | The Spiral Swirl | "[T]ries to introduce the notion of motion depicting a more dynamic and flexible model, moving users and information resources into a spiral swirl up and down into the depths of knowledge, exploration, and experience" (p. 45). |
| Bertot, J. C., & McClure, C. R. (2003). Outcomes assessment in the networked environment: Research questions, issues, considerations, and moving forward. *Library Trends* 51:4. | Outcomes and Performance Measurement in Libraries | "Inputs and outputs form the basis for service quality and outcomes assessment activities. *Outcomes assessment* seeks to determine the impact of the library's services/resources (again, outputs) on the library service and resource users. One cannot have outcomes measures without measures of outputs—libraries need to know what investments (inputs) produce what services (outputs) in order to determine the perceived quality (quality assessment) and impacts (outcomes) of those services/ resources" (p. X). |
| Hernon, P. (2002). Outcomes are key but not the whole story. *The Journal of Academic Librarianship, 28,* pp. 54–55. | Aggregate Factors Approach | Sees "library planning and decision making as revolving around service quality and its companion concept, satisfaction, and outcomes (or more precisely outcomes assessment). Inputs and outputs support the accomplishment of service, quality, satisfaction, and an assessment plan" (p. 54). |
| King et al. (2003). Library economic measures. *Library Trends, 51*(3). | Derived Measures | "Measures are designed to serve the perspectives of library staff management, library users, the fundors of the library and the higher order community served by the library" (X). "Outcomes are best determined by relating them to the purposes for which the information is obtained . . ." (X). |
| Fraser, B. T., & McClure, C. R. (2002). Toward a framework for assessing library and institutional outcomes. *Portal: Libraries and the Academy, 2,* pp. 505–528. | Preliminary Framework of the Outcomes Assessment Process | Model depicts "a basic process by which an academic research library helps meet the goals of particular departments and functional units within a university, which in turn contribute to institutional goals, while acknowledging that libraries may also contribute more directly" (p. 519). |

* The authors wish to thank Kim A. Thompson for her assistance in compiling the citations in this table.

Table 2, based on research by the authors and others, summarizes the view of the outcomes assessment environment of public and academic libraries from selected perspectives. Each of the described approaches has strengths and weaknesses; each makes implicit assumptions about outcomes and the relationships between outcomes and other evaluation factors; and most do not address a range of factors and considerations discussed later in this article. In short, it is not possible to address meaningfully the research questions posed initially in this article with such different views of outcomes and the relationship of outcomes to other evaluation approaches.

The authors of this article present a view summarized in Figure 2. This model, based on a number of large-scale field-tested and empirical research

*Figure 2.* Outcomes and Performance Measurement in Libraries.



efforts, posits that inputs and outputs form the basis for service quality and outcomes assessment activities (Bertot, McClure, & Davis, 2002; Shim et al., 2002; Bertot, McClure, & Ryan, 2001). In this view, *inputs* are the resources that libraries invest (e.g., money, staff, workstations, online commercial databases) in order to produce *outputs* (e.g., number of users of the workstations, number of database content downloads, circulation of material). *Quality assessment* involves determining the degree to which users find the library services/resources (outputs) to be satisfactory. *Outcomes assessment,* however, seeks to determine the impact of the library's services/resources (again, outputs) on the library service and resource users. In other words, one cannot have outcomes measures without measures of outputs—libraries need to know what investments (inputs) produce what services (outputs) in order to determine the perceived quality (quality assessment) and impacts (outcomes) of those services/resources.

*An Outcomes Framework—More than One Type of Outcome*

Much of the outcomes literature presents outcomes as monolithic—that is, there is a set of generic outcomes that fit various organizational settings (IMLS, 2000). However, it is important to recognize that there are many types of outcomes, such as research and learning outcomes (Hernon & Dugan, 2002) as well as institutional outcomes (Fraser & McClure, 2002). Developing a framework for outcomes assessment requires a complex analysis that encompasses the operating environment of the library, the impact of situational factors on library services and resources outcomes, and the reality that it is not always possible for libraries to anticipate and/or predict the outcomes of their services/resources on users.

Different types of outcomes have been suggested by Lance et al. (2002), Hernon and Dugan (2002), Bertot (2001), and Fraser and McClure (2002) —to name a few. As a result, developing a framework for outcomes assessment requires a complex analysis that considers a number of outcome types:

- *Economic.* Economic outcomes would include the impact of library services and resources on the ability of library users to prosper financially, seek employment successfully, or develop and sustain a small business in the community;
- *Learning.* Learning outcomes would include the impact of library services and resources on the ability of library users to engage in lifelong learning, interact with and engage a number of information resources, develop information literacy skills, develop technology skills, become literate, or develop an analytic ability to assess the validity and reliability of information sources;
- *Research.* Such outcomes might include the impacts of library services and resources on the research process of faculty and students in a university—e.g., assistance in proposal writing, grant receipt, and publication;

- *Information Exchange.* Information exchange outcomes would include the impact of library services and resources on the ability of library users to interact with government, exchange information with distant family, or receive information regarding countries of interest (e.g., foreign newspapers and other sources);
- *Cultural.* Cultural outcomes would include the impact of library services and resources on the ability of library users to develop an appreciation for fine arts, history, music, diversity, or other societal aspects; and
- *Community.* Some library outcomes affect the local community, be that an academic setting, a city or town, or a virtual community. Such outcomes could affect the overall quality of life for members of the community, attitudes of community members toward services, or even the political landscape of the community.

These categories are not mutually exclusive but rather are intended to be illustrative of types of outcomes. It is possible to identify other types of outcomes, as well as to expand the nature of the outcomes categories presented above. The key point is, however, that outcomes can be many and varied—and produced by the same service or resource (e.g., public access Internet workstations, online databases).

As identified in Table 3, there are two additional aspects of outcomes that researchers and practitioners need to consider: the level of outcome applicability and the time dimension of the outcome itself (discussed below). It is important to note that outcome types may apply at different levels (illustrated by the columns in Table 3). For example, a learning outcome may apply to the:

- *Individual user* of the library's services/resources by gaining the ability to read;
- *Library* by having a now-literate customer consume other library services/resources and derive additional impacts/benefits;
- *Community* by now having a literate member who can seek and expand his/her employability; and
- *State and nation* through a more economically solvent individual who contributes more to the economy through higher wages.

As such, outcomes can have multiple impacts for the individual user, library,

*Table 3.* Outcomes and Outcome Levels.

| Outcome | Outcome Level | | | | | |
|---|---|---|---|---|---|---|
| Time Dimension | User | Library | Institutional | System | State | National |
| Anticipated | | | | | | |
| Emergent | | | | | | |
| Unanticipated | | | | | | |

library institution (e.g., university), system (i.e., state university system, public library system as a whole), state, and nation.

According to some authors, outcomes assessment implies that outcomes are predefined through a planning process in which libraries engage (Hernon & Dugan, 2002; Fraser & McClure, 2002). In this view, outcomes are established *a priori* through service and resource goals and objectives developed through a planning process; there is some type of pretest in which libraries ascertain the extent to which their services/resources meet these goals and objectives according to users; and then, after user exposure to the new and/or modified library services/resources, the library measures the impact (outcome) of the services/resources through a posttest. Again, this is an oversimplification of the outcomes environment. Indeed, it is possible to have outcomes that are on different time dimensions as the rows in Table 3 demonstrate. Outcomes can be:

- *Anticipated.* These are the outcomes for which the library plans and by which the library intends to measure its success/failure in goals and objectives attainment. The library expects to achieve certain outcomes through its services/resources and then seeks to ascertain the extent to which its services/resources achieved the anticipated outcomes. It is important to note that anticipated outcomes can be generated by the library or imposed externally by funding agencies (e.g., the Institute of Museum and Library Services) or governing authorities (e.g., university boards and provosts, accreditation bodies, city council, etc.). Most outcomes work to date focuses on this type of outcome assessment model.
- *Emergent.* These are outcomes that emerge through the service/resource planning and implementation process. Such outcomes are not the immediate focus of the service/resource goals and objectives—either library or externally imposed. However, as the library develops its service/resource plans, these additional outcomes become apparent and are incorporated into the assessment process.
- *Unanticipated.* Once a service/resource is in operation, there are those outcomes that derive from actual service/resource use or interaction and can be ones that neither the library nor others predicted—nor planned to assess. For example, in the early years of public library Internet connectivity, many public librarians anticipated that the primary outcome of Internet connectivity in their libraries would be for information seeking, and quickly discovered that the primary outcome was communications—the ability of users to stay in touch with family and countries (McClure & Bertot, 1998). This outcome is still prevalent in public libraries, as demonstrated recently by Lance et al. (2002). By the same token, universities enhanced their Internet connectivity in their goal to become "wired campuses." Of the many anticipated outcomes

associated with robust connectivity, one unintended outcome was the substantial use of university resources by students to access online music services (some later deemed illegal). A number of universities now block access to such services from their campuses to preserve their connectivity resources, as well as to limit the universities from liability due to various copyright infringements.

It is clear that outcomes are not always anticipated either by librarians or others with expectations for library service/resource use. By focusing on the anticipated outcomes, librarians (and others) ignore significant emergent and unanticipated outcomes—both positive and negative. Any outcomes assessment strategy, therefore, needs to incorporate the ability to discover and articulate outcomes that were not the intended focus of the services/resources—something not likely in a pre- or posttest quasi-experimental methodology.

*Outcomes Assessment Methodology Issues*

Embedded within the discussion of the types of outcomes identified above is the notion of gap identification. In an ideal situation, a library anticipates a set of outcomes from its services/resources, and the library's user community confirms those anticipated outcomes. It is more likely the case, however, that outcomes reside within a zone of tolerance in which library intended outcomes and user assessment of those outcomes are within an acceptable range—or minimal gap. There may be multiple gaps or zones of tolerance—the library, the university, the user—all of these constituencies comprise the outcomes space within which the library's services/resources reside. There is a need to explore further the notion of gap analysis in outcomes assessment activities such as is being done with service quality research activities (Cook et al., 2001).

Another critical factor in outcomes assessment is the ability to isolate the actual impact of library services/resources on the user community. As an example, we use one of Smith's (2000) institutional learning outcomes for university libraries, *Develop Attitudes of Openness, Flexibility, Curiosity, Creativity, and an Appreciation of the Value of a Broad Perspective.* Let us create a formula based on general linear model (GLM) analysis techniques for which one might use analysis of variance (ANOVA) or multiple regression to analyze:

| | |
|---|---|
| Dependent Variable = | Students develop attitudes of openness, flexibility, curiosity, creativity, and an appreciation of the value of a broad perspective |
| Independent Variable(s) = | Particular library services/resources + courses + student extracurricular activities + ... + ? |

In quantitative terms, researchers as well as librarians and university officials will want to know what library services/resources contribute, in what

way, and how much, to the student body's development of *attitudes of openness, flexibility, curiosity, creativity, and an appreciation of the value of a broad perspective.* In other words, the assessors of program outcomes will want to know which library services/resources contribute to the attainment of the outcome, as well as by how much, and in what way(s).

Needless to say, it is near impossible to quantify, much less isolate, a university library's contribution toward the outcome identified above. Simply put, student "attitudes" are formed by any number of campus activities in which students might engage—from coursework to mentoring by faculty to clubs to which the student may belong, etc. Library services/resources do not exist in a vacuum and measurement techniques will need to take these external and likely contributing factors into account. This is particularly the case when outcomes are presented as an institutional (i.e., university) objective but measurement occurs locally (i.e., at the library). To ignore the other university activities that likely contribute to the outcome would yield an incomplete picture of library contributions to outcome attainment at best and distort the library's contribution to outcomes attainment at worst.

## The Complexity of the Library Service Environment

Libraries now reside in a complex service environment—one that requires that they provide traditional services and resources such as a physical space, print material, and face-to-face reference, as well as network-based services such as Web-based collections, online databases, and virtual reference (Bertot, 2000; McClure, Fraser et al., 2002). Libraries are, therefore, providing more services and resources through multiple delivery methods. Moreover, while these traditional and network-based services are perhaps related and similar in function, they differ vastly in a number of significant ways such as the infrastructure required to deliver the services, the ways in which users or user communities access the services, the skills and knowledge required by uses or user communities to use the services, the reach and range of the services, the ways in which libraries manage such services, and the skills required within the library to deliver and access such services.

The networked environment is an intricate series of networks that interconnect in such a way that users never completely know the route they took to retrieve the information or resource that they sought. As Smith and Rowland (1997, p. 170) note, local users can access local resources, remote users can access local resources, and local users can access remote resources. Such a multifaceted environment—one in which the library is the resource or the library is the resource gateway for local or remote users—creates a complex environment for measurement. Data collection and research activities, therefore, need to reflect this complexity and multidimensionality of electronic networks. They also need to recognize the need for collect-

ing a range of data for use at the organizational (library), institutional (university, county government), state, or national levels.

The implications for outcomes assessment due to this environment are numerous. They include, but are not limited to:

- *Many library network-based services are not truly the services of that library.* For examples, libraries license the use of such vendor-based services as EbscoHost and ScienceDirect. As such, they do not own, but rather lease, such "collections." Therefore, any measurement activities that assess the outcomes of library services need to take into account that libraries do not have direct control over such services. Thus, how best to "count" basic networked service interactions is complex (Shim & McClure, 2002).
- *Users can and do access network-based services from numerous locations using a wide range of technology and telecommunications services.* Each of these variations in access can and does affect the experience of the user—and these variations are beyond the purview of the library. Indeed, some library users do not access the library physically.
- *The type of interaction that users can have with a library's network-based services and resources versus a library's physical services and resources can be quite different.* Virtual users do not "browse the stacks" as do physical users. Moreover, not all of a library's collection is available in digital format; thus, virtual users are often limited to certain types of resources and services. In some cases, a service or resource is only available in electronic format. Another service that libraries provide increasingly is user training (e.g., use of technology, use of databases, other). Online tutorials differ greatly from in-person training in a library lab setting.

These issues suggest that research activities cannot regard all users as the same, nor can they treat all library services and/or service delivery modes as the same.

## Considerations and Concerns

As identified earlier in this article, the discussion of outcomes and outcomes measurement in libraries and related information organizations is in its infancy. There are more questions about outcomes and outcomes assessment than there are adequate answers at this point. Indeed, it may be that at some point in the future, researchers will determine that outcomes and outcomes assessment have little utility in library organizational and services evaluation because of problems of implementations—especially in a networked environment. The research questions posed in the beginning of this article only scratch the surface of those that require attention. As the research and library communities move forward in studies related to outcomes and outcomes assessment, there is a need to make explicit some assumptions, considerations, and concerns.

*Need for Empirical Research*

At present, there is no lack of opinions and views related to outcomes and outcomes assessment. But, there is a lack of empirical research related to outcomes, outcomes assessment, and conceptual frameworks that would help practitioners to understand better the basis for, application of, and use of outcomes assessment. One empirical effort was the Association of Research Libraries' sponsored E-metrics study (Association of Research Libraries, 2002). One aspect of the E-Metrics project explored the role of the academic library in its contribution to achieving institutional outcomes. Findings from the E-Metrics study suggest (Fraser and McClure, 2002):

- The inputs-outputs model for library assessment (which produced the statistics and measures in the report *Measures and Statistics for Research Library Networked Services: Procedures and Issues*) may not be linked easily to demonstrating the library's role in accomplishing institutional outcomes.
- Many of the library's activities, resources, and services are combined with other institutional activities, resources, and services in such a way that parsing out *only* the library's contribution to institutional outcomes is extremely difficult.
- The process by which libraries are involved in the identification of and agreement to these institutional outcomes is not clear.
- There is widespread confusion as to what an "institutional outcome" is and how such outcomes "fit" into traditional assessment procedures.
- Increasingly, academic accreditation agencies are considering the use and appropriateness of "institutional outcomes" as a means to assess the degree to which the organization determines what end products *should* result from organizational activities.
- The issue of nonexistent or inconsistent incomparable usage statistics provided by external information content providers (vendors) is a major stumbling block for libraries to gauge rapidly increasing use of electronic resources by research library users, thus making it difficult to use the data as sources for establishing library outcomes.

To a large degree, the E-metrics study found that academic libraries are not well prepared to demonstrate the extent to which they contribute to the organization's accomplishment of institutional outcomes. Moreover, libraries are looking at outcomes at the library level when, in fact, they reside within an institutional context. Nonetheless, there appears to be considerable interest in identifying and measuring the degree to which the academic library *does* contribute to accomplishing such institutional outcomes.

One of the products from the E-metrics study was a proposal for additional research in the area of outcomes, "Identifying and Measuring Library Activities/Services Related to Academic Institutional Outcomes" (McClure

et al., 2002). The proposal outlined a conceptual framework for understanding outcomes assessment that has yet to be tested. In fact, there are few efforts to propose conceptual frameworks (such as that offered in Figure 2 earlier in this article) to help researchers lodge such research in the broader frame of evaluation theory. Thus, empirical research projects are necessary to understand better and describe outcomes and outcomes assessment—regardless of the type of outcomes being investigated.

*Need for Multimethod Approaches*

From the issues identified and discussed in this article, it is clear that research endeavors cannot treat all users as the same, all delivery of library services in the networked environment as the same, nor should they lump generically library services for assessment purposes. The differences between online and physical services/resources are real and not comparable (Bertot, McClure, & Davis, 2002; Shim et al., 2002; Bertot, 2001). Research efforts that do not separate network-based library services and resources from physical services/resources—such as work by Hernon and Dugan (2002) and Hernon and Whitman (2001)—miss substantive differences and, ultimately, the ability to determine library service and resource quality and outcomes.

While there is a need to focus much research on outcomes, such research should not occur at the exclusion of promising work in other areas of assessment. For example, there is a range of other efforts currently underway to assist the library community in the assessment of services and resources. These other efforts focus on:

- Service discrepancies among different stakeholder groups (e.g., LibQUAL+);
- Inputs analysis;
- Outputs analysis;
- Cost/benefit analysis;
- Performance measures (that can combine inputs and outputs); and
- Quality standards.

The issue is not which of these, or others, is the *best* approach for libraries. The issue is better stated as: Given the needs of the library, the resources available to the library for assessment, the assessment activity objectives, and the staff skills available—*what methods for assessment will be most useful and successful?*

Oftentimes, a combination of methods is best as each method has its own strengths and weaknesses. For example the recently published manual *Statistics, Measures, and Quality Standards for Assessing Digital Reference Library Services: Guidelines and Procedures* (McClure et al., 2002) offers some thirty-five performance measures related to the provision of digital reference services as well as six suggested areas for quality standards. These measures and qual-

ity standards are a first comprehensive effort for assessing digital reference services. Inclusion of cost-benefit analysis, service quality approaches, and outcomes assessment could also be incorporated with the approach described in the manual. As methods are integrated and expanded, however, the cost and level of effort required to conduct the assessment increases.

Multimethod approaches are also likely to be most useful given the range of situational factors that affect individual organizations and libraries. The type of assessment required for a small rural public library that is a member of a large regional cooperative with few staff and resources is likely to vary considerably from a large academic library that purchases an extensive collection of electronic resources, has talented technology staff, and provides customized networked services to its academic community.

In the experience of these authors, one evaluation method does *not* fit all types of libraries. The promotion of one particular method by some at the expense of all other methods does not reflect the complexity of situational factors as they relate to assessment in a library context. Nor might a single approach provide reliable and valid research results in all library organizational settings—there is a need for flexibility in methods and execution for libraries to engage successfully in evaluation activities.

*Impact of the Networked Environment*

As discussed earlier in this article, assessment of library services and resources—regardless of method—needs increasingly to consider the role and impact of *electronic* services and resources. Assessment of electronic services and resources, especially in a networked environment, involves a very different set of circumstances than those in the print and physical environment (McClure & Bertot, 2001). Assessment in a networked environment raises the following unique issues:

- The technology for the delivery of these services and resources is constantly changing, which affects what services/resources a library can deliver and how such delivery might occur. This also affects the methods, approaches, and software that enable the "tracking" of such services/resources;
- There is a need to have comparative (and valid) measures for traditional versus electronic-based services and resources, e.g., is a physical visit to the library (turnstile count) comparable to a visit to the library's Web site?
- Oftentimes, libraries contract (license) for networked services or do not control their own technology infrastructure (e.g., servers), thus they cannot easily obtain transactional data describing services and resource provision;
- The increased reliance on consortia and other group arrangements for the purchase and delivery of electronic services and resources blurs actual costs for these services and resources as well as how these services and resources are being used;

- Related to the above, leased services/resources are not truly the services/resources of the library. Rather, the library acts as a gateway to such services/resources. Outcomes assessment activities need to consider the most appropriate strategies for evaluating the outcomes of services/resources that are technically not the library's; and
- Librarian skills necessary to conduct outcomes and other types of assessment in the networked environment are significant and require constant enhancement given the changing nature of that environment.

*Ease of Use*

One major concern regarding the development of outcomes assessment methods is the ability of libraries to implement the recommended approaches, data collection activities, interpret the results, and use the findings to inform library resource/service planning efforts as well as external library stakeholders. Thus, it is imperative that researchers engaged in the development of outcomes assessment tools consider the degree to which the methods are practical and feasible for day-to-day use in libraries and other information organizations. As this article indicates, however, the ability of researchers to meet this ease-of-use burden remains unclear as outcomes assessment requires complex indicators and methods.

To some degree, outcomes assessment is a theory in search of a practice. From the earliest days of the development of various output measurement manuals in the early 1980s, many practitioners remain unconvinced that the amount of time and resources necessary for conducting assessments—of any type—is worth the bother. Despite a major effort at making *Output Measures for Public Libraries* (Van House et al., 1987) easy to use, practical, and useful for library decision-making, some practitioners found that this, and similar assessment manuals, required too much time and effort to implement.

A major difficulty with outcomes assessment is that understanding outcomes, developing approaches to use outcomes as an assessment technique, training staff to be able to implement outcomes assessment, and then using the results for decision-making can be time-consuming and difficult. Despite attempts for practical outcomes assessment manuals (e.g., Florida State Library, 2000) much work remains to be done to make outcomes assessment a practical, valid, and easy approach that will be embraced by the library community. Those developing such manuals need to work toward methodologies that are feasible, cost effective, and actionable with relative ease. It is unclear at this time how well outcomes assessment—as a method—can be demystified and integrated easily into an ongoing library evaluation program.

*Local Judgment Calls*

Missing from a number of discussions about the importance of outcomes and outcomes assessment is the discussion of what are the "correct," "appropriate," or "right" outcomes for a particular library setting. Thus, the

research question here is: What factors within the library and the local community affect the judgment of when a service is "good enough"? The issue becomes more complicated if the library has to accommodate its outcomes with those of a larger institution (university or city government). Moreover, once there is a selection of a particular outcome as appropriate for that setting, "how much" of that outcome does the library need to obtain to claim "success"? Similar issues occur in other types of assessment methods. The concern, however, is in method replacing value judgments on the part of the users of these methods.

As an example, the performance measure "correct answer fill rate," offers no guidance unless we know if a 50 percent correct answer fill rate is acceptable for a particular library or if a 75 percent correct answer fill rate is desired instead. Having a performance measure, or having an outcome, is not the same as agreeing on the quality or performance level that a library wishes to achieve on that outcome or performance level. It is the responsibility of the individual library or organization to develop a process that results in agreement that the quality standard for correct answer fill rate might be something like, "reference staff will answer quick fact and bibliographic questions correctly 70 percent of the time."

The quality level or "standard" that a library or organization accepts as a benchmark by which to judge itself depends on:

- Institutional and library goals and objectives (either developed internally or imposed externally);
- Stated priorities among those objectives (libraries cannot be all things to all people all the time);
- Resource allocations among goals, objectives, and services;
- Staff knowledge and skills in providing information services; and
- Other situational factors at play at an individual setting.

The easy part of evaluation may be identifying and validating the performance measures, outcome, or various statistics as indicators of information services. The hard part may be the development of a process within the organization to agree on the quality standards for those outcomes that are acceptable, or are the target, for that particular organization. In short, outcomes assessment has little utility without accompanying quality standards, and these require judgment calls on the part of the users of such methods.

*Recognizing the Political Context of Outcomes Assessment*

Evaluation, overall, has significant political overtones beginning with the determination of what to evaluate, how it will be evaluated, what outcomes are most important, what measures to use, how to interpret findings, and how best to report or present the findings. Noticeably absent from a number of the discussions of outcomes assessment are considerations re-

lated to the political environment in which the library exists. A determination of "appropriate" outcomes by the larger institution can eliminate effectively the ability of the library to demonstrate how it supports those outcomes. In addition, these political considerations are compounded because of the network and technology infrastructure through which library services and resources are provided. For example, a public library that is dependent on a city's technology infrastructure for its network and resultant services has a more complicated political context for determining and measuring outcomes than a library that controls its own technology.

Dealing with the various political issues related to outcomes and outcomes assessment in a networked environment is new to most libraries. In addition, outcomes assessment in the highly charged technological infrastructure of many organizations requires the evaluator to have a range of skills and knowledge not needed in the nonnetworked environment. Research is needed to shed light on those serious issues.

## Moving Forward

As suggested in the key research questions posed earlier in this article, it is necessary to view research related to outcomes and outcomes assessment in the larger context of overall library and information services assessment. Outcomes assessment is but one method that has the potential to help library managers make better decisions regarding the provision of information services and resources. At present, however, there are many issues and problems with practical implementations of the approach. While there certainly is potential for developing outcomes assessment, much work—especially empirical research—is necessary.

As discussed previously, use of the terms outcomes, performance measures, quality standards, service quality, etc. continue to be disputed. As Kyrillidou (2002) concludes in a recent article, not only is there a need for more dynamic models to describe libraries and users, "we lack an adequate shared understanding of how outcomes are defined" (p. 45). The framework outlined in this article (see Figure 2) is one effort to help clarify the use of these terms and provide a means to understand their relationship to each other. Without better agreement among researchers about the use of these terms there is likely to be limited implementation of these various assessment techniques. Indeed, at a recent workshop conducted by the authors, a participant commented, after a review of the various assessment methods and approaches, that researchers and writers studying outcomes were like kids playing in a sandbox—and that clear, practical, usable evaluation methods and approaches are not available to practitioners.

Also lacking from many library evaluation approaches is adequate recognition of how the networked environment affects services and resource provision. As shown earlier in Figure 1, the way online services are accessed raises a range of evaluation issues that require substantial attention. A

key theme throughout this article is that outcomes assessments, as well as other types of library assessment, have yet to address factors and issues arising from the networked environment that seriously complicate valid assessment approaches. Indeed, little of the outcomes assessment work to date considers the evaluation of network-based services or resources—and how those services/resources differ from traditional library services or resources. And yet, libraries are increasing the network-based services and resources that they provide.

There are a number of possible next steps for researchers working in the area of outcomes assessment:

- Develop a better understanding of outcomes and how outcomes "fit" into the range of evaluation models. This could be done by comparing the strengths and weaknesses of the models as shown in Table 2 and by reviewing the considerations given in this article that the models do not address currently.
- Specify and rethink college and university accreditation documents to better determine what they mean by outcomes assessment and the process by which such assessment should be done. The review of such accreditation documents by Gratch-Lindauer (2002) clearly identifies confusion and lack of understanding by these accreditation agencies concerning outcomes assessment.
- Involve library practitioners in research related to outcomes to obtain their knowledge, views, and experiences in evaluation.
- Conduct empirical research on the validity of Table 3 in this article and determine the degree to which outcomes are similar or different in a traditional (print and face-to-face service provision) environment versus a networked environment.
- Conduct empirical research that determines the extent to which outcomes are generic and, thus, obtainable and comparable across a range of libraries and library types based on library situational and other factors.
- Sponsor a small meeting or symposium in which key researchers and practitioners could debate and discuss a range of issues and concerns regarding outcomes assessment. Such a meeting could help focus attention on how best to attack outcomes assessment as an evaluation method.

These are only a few efforts possible to begin to address some of the research questions identified in this article. Until such steps are taken and a range of research activities initiated, outcomes assessment will continue to be an idea in search of both a theory and a practice.

There is much work yet to do in translating outcomes assessment and other evaluation approaches into practical, useful, and valid assessment techniques in the networked environment. The track record for the degree to which practitioners have embraced a program of ongoing evaluation (regardless of the method) is extremely low. Lakos (1999) identified

the need for a "culture of assessment" within libraries years ago—and it is still lacking in large part. Needed now is more *empirical* research related to these evaluation approaches; evaluation methods that recognize and understand the role of the networked environment in the provision of services and resources; partnerships with libraries and related organizations to test, refine, and validate practical and doable approaches; and a commitment to developing multiple evaluation methods that can work successfully together.

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# Electronic Publishing: Research Issues for Academic Librarians and Users

Carol Tenopir

## Abstract

Increased reliance on electronic resources requires examination of the roles of librarians in several key ways. This paper addresses the need for further research into three important areas of electronic publishing. How is the change to digital information sources affecting the scholarly work of college and university students? Previous research shows that students rely on Web and online resources and ask for less help from librarians. We do not know, however, how these changes will affect the learning and scholarly work of college and university students. Research is also needed to determine how the differences between separate article and full journal databases affect the way research is done. What are the implications for scholarship of decisions being made about what publishers publish and what librarians purchase? Finally, are librarians—as intermediaries to the search process—still necessary in a digital age? Online systems are designed to be used independently but that may not always yield the best results.

## Introduction

In the rush to a digital information world we rarely pause to consider the long-term effects on libraries, scholars, and students. Even more rarely considered are the long-term effects that changes in the media of scholarly communication may have on learning and understanding of content. Marshall McLuhan (1964) understood the relationship between variations in media and meaning over time and the impacts of these variations on society when he famously declared that the "medium is the message."

McLuhan was concerned mostly with television, radio, and mass media, rather than with scholarly information sources. It is difficult to know if

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 614–635

such concerns are valid for the materials that academic libraries emphasize—scholarly research reports, journals, and other reference and information resources that are used for finding information rather than for entertainment or news. If the same scholarly information is available in both printed and digital form, are there differences in how it is used and understood? Or, does the content stand separate from the medium through which it is delivered? How can librarians and other information professionals apply their knowledge about how scholarly materials are organized and used to help people make the most of the information available to them?

Many research questions can be posed concerning this general issue, including:

- How does the medium of information affect people's preferences, understanding, and use of the content?
- Do people seek for, understand, and use information delivered in digital form differently from that delivered on paper?
- Does the medium of information resources used make a difference in the new knowledge people create from these information resources?
- How does a library's choice of format for information products affect the library users?

These very broad questions need to be answered in the coming decade as libraries continue to move to digital services, but to answer such general questions, many more specific research questions must be addressed. This article explores three of the specific research questions that are critical to the delivery of effective library service to students and scholars.

1. Medium and Student Work: How is the change to digital information sources affecting the scholarly work of college and university students?
2. New Models for Scholarly Journals: When libraries select electronic journals, how do the products offered to them or the models they choose (such as a database of separate papers rather than a journal issue model) influence scholarship and the way journals are used?
3. Librarians as Intermediaries: Are librarians—as intermediaries to the search process—still necessary in a digital age? What do human information professionals bring to the online research process that cannot be adequately duplicated online?

## Question One: Medium and Student Work—How Is the Change to Digital Information Sources Affecting the Scholarly Work of College and University Students?

This includes several subquestions, including: Are there differences in citing patterns, quality of work, and the research process? When faculty assign papers that require students to use the recorded knowledge, what

do they expect and how has this changed? How can educators and librarians influence students' work in a positive way?

*Why This Question Is Important*

It is unclear how the move from paper-based library collections to digital collections is affecting scholarly work. In the past when faculty assigned research papers to their students, the expectations of what types of sources would be used and the role of librarians in providing access to these sources were fairly clear. Today, there is much more variety in media and sources available to students and students often do their research without setting foot in a library. Libraries purchase electronic resources and students access the resources from their dormitories, homes, or offices. Students may not seek help from librarians, either because they have confidence in their online searching skills or because they no longer come to the libraries and librarians are "out of sight, out of mind."

Librarians have always been concerned that college students demonstrate basic information literacy skills, but in today's virtual library environments teaching these skills may be more important (and less controllable) than ever. In 2000 the Association of College and Research Libraries (ACRL) adopted competency standards for information literacy that recommend: students must be able to articulate information needs, know how to search for and access information resources, and effectively use the information they find (http://www.ala.org/acrl/standardlo.html). Librarians face new challenges in reaching students who only access library resources online and have grown up with the Web. It is difficult to make sure that such students know how to select appropriate resources, evaluate the quality of what they select, and use these resources well regardless of format or medium.

Academic librarians and faculty members would likely agree that most college students today prefer digital resources to print resources. Even within the realm of digital resources, a majority of undergraduate students seem to choose Web sites or digital resources that include the full text often without regard to how appropriate the source is for their assignment. The impact of this is not yet known, but several aspects of this issue need to be studied.

Librarians need to know more about how students make decisions regarding what information sources they use for their class assignments, in order to design better library instruction programs and so librarians can work more effectively with faculty and with students. If these decisions are based more on the convenience of electronic full texts or affinity for the Web, we need to understand how the change to digital information sources is affecting the scholarly work of college and university students. The prevalence of electronic resources is likely causing changes in students' citing patterns and may be even changing the quality of work and the research process. Ultimately, understanding these changes in the work habits of

undergraduate students may help educators and librarians influence students' work in a positive way.

*Previous Work*

*Student Preferences.* In the late 1990s, Tenopir (1999) and Tenopir & Read (2000) recorded academic librarians' observations of online use among students in all types and sizes of colleges and universities. These surveys found that appropriate content, recommendations from trusted people, and ease-of-use are all believed to be important factors that influence which research online resources are selected by students. The one factor, however, that was found to be most important was the availability of the full text. (In fact, availability of full text was mentioned by almost all respondents from every size of library.) According to one librarian from a small college: "Students expect to see the full article pop out. Also, full-text greatly enhances our own, small collection." Another respondent explained, "The concept of one-stop information shopping is an important factor in using any electronic information resource" (Tenopir, 1999).

Full text often overrides all other preference factors, in particular for undergraduate students. Librarians who have faith in users to pick the best content sometimes change their opinion when full text is the issue, and, increasingly, not just any full-text will do. One librarian summarized the new expectations: "End users want full text; preferably with graphics and they want it delivered over a Web interface that provides the flexibility for a variety of output and access options" (Tenopir, 1999, p. 38).

When more than one full-text database is available, students may choose the resource that is best suited to their research needs, although convenience and recommendations by peers, instructors, and librarians are influential. Librarians reported in the Tenopir survey that when products are recommended specifically by their instructors or by librarians, students generally use them.

*Faculty Concerns.* Many university faculty are concerned that students choose the convenience of full-text digital resources (and in particular, free Web sites) without regard to quality or appropriateness for their tasks. One recent study (Herring, 2000) found that although faculty respondents feel positive about the Web, they expressed concerns about their students' ability to evaluate Internet resources and questioned the accuracy and reliability of Web resources. Rothenberg attributed a decline in the quality of student term papers—both in quality of writing and originality of thought—to reliance on the Web for research. In a recent survey of academic research libraries (Tenopir & Ennis, 2001, 2002) one respondent commented that "more and more faculty are unhappy with the Internet resources their students are using and have come to the librarians to help instruct students on reliable resources" (p. 270).

Some students may not be aware of the need to carefully evaluate Web

and other full text sources. Grimes & Boening (2001) found that students are using Web resources in English composition assignments without evaluating the quality and reliability of the sources, contrary to the expectations of their professors.

Preference for resources that are convenient and familiar is natural, of course. Not all faculty, and certainly not all students agree that the Web has had a negative effect on student work. McBride & Dickstein (1998) saw no decline in quality of student writing in Women's Studies at the University of Arizona, even though the Web was used more often for research. A 1998 survey by librarians at Duke University found that 20 percent of undergraduate students interviewed felt the Web had a positive effect on their work, while another 40 percent felt the Web made a difference to the quality of their work. Over half identified the Web as a time saver (Lubans, 1998).

D'Esposito & Gardner (1999) found that undergraduate students are aware that quality is an important factor to consider when selecting Web resources to use for schoolwork. Students in their study reported that government, educational, and reputable business sites are the most reliable. Undergraduate students studied by Wei He & Jacobson (1996) felt strongly that the Internet was useful for research and seeking information.

*Motivation.* Motivations of students who use the Web were studied by Ko (2000) from the perspective of media uses and gratification. Ko (2000) found that students with higher motivation tended to go more to informational sites (in contrast to recreational or social sites), but she did not examine the quality or accuracy of the informational sites they visited. Duggan et al. (1999) asked students to self-judge "valuable educational" Web sites. They found that students who keep track of these sites have a more favorable attitude about using the Web for class assignments. Many of these studies imply that, contrary to faculty belief as measured in other studies, some students are aware of the need to judge quality of Web sites. The problem may simply be that they do not know how to do so. Instruction by librarians on how to evaluate topical Web sites and integrate them into classes may help solve this problem.

It is not surprising that peoples' motivation levels influence how much effort they put into a task and how long they stick with it. It has been well demonstrated that motivation plays a role in what medium users select (Lin, 1999). The use of digital research materials is no exception, whether the searchers are students, scholars, or scientists.

Research by Nahl & Tenopir (1996) and Tenopir, Nahl-Jakobovits, and Howard (1991) found that time spent online and search strategies varied if faculty or university students were searching for personal or for work-related purposes. More highly motivated users spent more time on a search and made more changes to their search strategies. Wildemuth et al. (1992) found that the search moves used by medical students varied with motivation (or what they called "search stimulus").

Motivation also plays a factor in what resources are selected. Ko (2000) discovered that when users are motivated to use the Web by the need to learn new things or to solve problems (considered by Ko as "information" motivations) they are more likely to visit "personal identity" and informational Web sites. Users who are online a lot are more likely to visit informational Web sites.

*Librarians and Recommendations.* Librarians are making adjustments to student preferences for the Web. One librarian responded to the Tenopir and Ennis survey: "we have found in the last couple of years that too many students, because they know how to use the Web are using only the Web itself to find materials for their assignments, rather than trying the periodical indexes that we offer via the Web. We've had to change our instruction efforts to address this problem. We don't discourage them from searching the Web for material on their subject in addition to using the indexes, but we talk a lot about the quality of what they find on the Web—the quality and the provenance" (Tenopir & Ennis, 2002, pp. 270–71).

A librarian's recommendation is believed by most academic librarians to be very important, although in most libraries trying to reach a large proportion of students and faculty is a constant effort. A database demonstrated in instruction classes or English 101 will be selected if students remember it when they need information. For those students who are motivated enough to ask at the reference desk, the recommendation of a specific source is believed to be very influential. Tenopir (1999) found that one library saw its usage statistics triple for a particular online system when they introduced a separate instruction class and promoted its use with faculty.

Recommendations of relevant sources may be most important the first time a student has to choose a database. After that, familiarity often takes over. If students have had success in a previous use, they are likely to select the same source again, even if "its use in this instance may or may not be appropriate" (according to a small college librarian.) Positive encounters are influential. "If their initial instruction and usage has been successful, I feel they keep returning to what is familiar," says another (Tenopir, 1999, p. 38).

*Changes in Citing Patterns.* Although there are many opinions among faculty and librarians, only a few researchers have studied what impact these choices have had on scholarship, whether positive or negative. Further research on this topic will help librarians make better collection development choices and will help faculty and librarians design optimal information instruction courses. Philip Davis at Cornell University is one of the few to study changes in the citing behavior of students over time (Davis, 2002a; Davis & Cohen, 2001).

Davis and Cohen (2001) found a significant decrease in the frequency of citing scholarly resources in microeconomics undergraduate term papers from 1996 to 1999. Scholarly materials are cited less often and nonscholarly materials such as newspaper articles and Web sites are cited more. The

prevalence of newspaper article citations can almost certainly be attributed to the widespread availability of full text newspaper databases such as ProQuest or LexisNexis Academic Universe through university libraries. The Web may be used from home or on campus. Disturbingly, Davis and Cohen found that approximately only one-half of the URLs cited in student papers led to the correct Web site. An update to this research found that the number of citations to Web sites and newspaper articles in undergraduate term papers continued to increase in 2000, but papers submitted electronically had a higher percentage of correct URLs (Davis, 2002a).

*Research Methods For Studying These Questions*

The importance of changes in what research sources are being used and cited is still difficult to judge. Davis (2002a) found no significant relationship "between grade and total number of citations, number of Web citations, number of scholarly citations, or number of non-scholarly citations" (p. 58). Further research is needed to examine the intellectual products created by students and their performance in relationship to the resources used.

Studying student preferences and faculty concerns answers only a small part of this important question. Librarians and faculty members can guide students to high quality resources in digital formats as well as in print. More important, but more difficult to understand, is how the inherent properties of a medium influence the learning process (if at all).

Most of the concerns by faculty and libraries are related to the quality and appropriateness of the content of digital resources used by students. Quality of content is likely independent of the medium, but undergraduate students may be willing to accept online sources without question. Increased emphasis on teaching evaluation skills, library created portals to authoritative Web sites, and stricter citation guidelines in class assignments are recommended by Davis and Cohen (2001) to help solve this problem in the future.

If such suggestions are followed, they should be tested to see if the problem truly lies in the quality of student work or in faculty perceptions of what citations are likely to lead to quality information. Further studies that look at the link between what is cited and the quality of scholarly output will help reveal if a problem truly exists. Academic librarians should work with teaching faculty to conduct such controlled studies.

A related research area is to test the effectiveness of user instruction that emphasizes Web site evaluation. Other than course requirements, what truly motivates undergraduate researchers? Is instruction in evaluation methods truly effective or is a more prescribed approach to acceptable resources in assignments necessary? Will student achievement increase after such instruction?

Finally, the larger issue of medium and understanding needs more re-

search in the scholarly domain, outside of the world of mass media. The Web combines components of mass media with a wealth of scholarly materials making interdisciplinary research appropriate. The work of communications research and information science research dovetails well in this research area.

## Question Two: New Models for Scholarly Journals—When Libraries Select Electronic Journals, How Do the Products Offered to Them or the Delivery Models They Choose Influence Scholarship and the Way Journals Are Used?

*Why This Question Is Important*

Faculty are concerned about what resources students use and cite because there is a long tradition of high quality being associated with peer-reviewed, scholarly journals. Scholarly journals provide scholars with a way to convey their own research findings and to keep up with what others are doing in their disciplines. Peer review provides a quality assurance mechanism. The structure of traditional journals has evolved to provide a forum for research, events, and controversies in each discipline. Through such devices as topic issues (bundling related articles on a topic into a single issue), letters-to-the-editor, book reviews, and editorials, journals have evolved to provide more to a discipline that just a body of individual research articles. It can be argued that a journal with a large following in its field, such as *Journal of the American Medical Association (JAMA), Reference and User Services Quarterly (RUSQ),* or *Tetrahedron Letters* builds or reflects the community of physicians, or reference librarians, or organic chemists who read it, subscribe to it, and/or publish in it.

Traditional scholarly journals continue to be the single most important information source for scientists and social scientists (Tenopir & King, 2000). Today, journals may still be delivered on paper (in fact, a vast majority still use print-on-paper as at least one option), but they may also be delivered digitally, either directly from the publisher or through an aggregator such as LexisNexis, ProQuest, or OCLC. Collection development policies for journals now often favor online versions of journals over print.

Digital distribution does not necessarily mean the end of the traditional journal, but it does provide many alternatives to journal article delivery. Publishers may continue to create their journals in issues and merely make each issue accessible on the World Wide Web to subscribers (or for free), individual articles can be separated from the journal issue and be made available in large full text databases that combine articles from many different journals, or authors may choose to post their scholarly work directly on e-print servers or their own Web page and forgo publishing in a journal altogether.

Electronic publishing clearly has many advantages for libraries, authors,

and readers, including a speedier publishing/distribution cycle, desktop delivery, and the possibility of wider distribution. The move towards electronic journals is well underway and, while it will move more slowly for some journal titles and some disciplines than others, it is a movement that will continue its momentum (Kling & McKim, 2000).

There are several aspects to this research question, answers to which will help publishers, librarians, authors, and readers design the best electronic journals for current and future scholars. We need to know if scholarly journals as we know them contribute more to scholarship and the furtherance of science than separate collections of research articles. If not, databases of separate articles with a good search engine may be the best way for libraries to provide access to the research literature. If so, the scholarly community needs to put pressure on publishers and libraries to continue the journal model.

To understand the consequences of such important collection development decisions, librarians and publishers must understand the contributions of a traditional form of a journal (either in print or digital form). A traditional journal that provides scholars in a discipline with a regularly issued bundled collection of related articles plus substantial nonarticle materials such as book reviews, letters-to-the-editor, and an editorial voice includes much more material than a database of articles. We need to understand the extent to which this additional information is valuable to scholarship.

Collection development and reference librarians must ask themselves, if we have a good search engine and separate collections of articles is this sufficient for scholarship? Libraries are canceling subscriptions to print and electronic journals in favor of the collection of articles model, often without asking if it matters to researchers and to research. Many times the collection of articles model is offered by a third-party aggregator, while the journal model comes directly from the primary publisher. Choosing aggregate models over journal models may, in the long run, cause smaller journal publishers to cease publication altogether.

Perhaps the old model of a journal is obsolete and new models of separate articles distributed through e-print servers, author Web sites, or in databases will replace traditional journals. Librarians now have choices and their choices will help to define the future. These choices should be based on full knowledge of the possible implications of their actions.

*Previous Work*

*Models for Access to Electronic Journal Articles.* To understand the need for research on these questions, it is necessary to understand the current state of electronic journal publishing. Electronic publishing is still in a state of development and experimentation, with many different variations concurrently available. Two main models are competing for subscription dollars and readers' attention: 1. the journal model, and 2. the article model.

The journal model retains the structure and purpose of a print journal, but it is delivered in digital form. It is usually available directly from the publisher (either commercial publisher or society publisher) as a Web product. The traditional publishing device of issues and volumes may be retained or articles may be put up on the electronic version as soon as they are ready, without regard to issue numbers. Editorials, letters, and short features likely appear with research articles as part of the electronic journal and a table of contents leads readers to the material. Subscription fees may or may not be charged. All in all, the journal model for electronic publishing retains the sense of community, branding, and editorial voice of the traditional journal, while taking advantage of what electronic distribution and formatting offers. Authors and readers approach an electronic journal much as they do a print journal—by recognition of the journal title as being of interest to them without necessarily knowing what specific information they will find each time they read it. Browsing is the most common method of searching for relevant information and tables of contents with links to the articles are key to browsing. Readers tend to stick to a handful of journals which they consider core to their work.

The "SuperJournal" research project in the United Kingdom found that scientists tend to favor the journal model more than social scientists (Pullinger, 1999; Eason et al., 2000; Pullinger and Baldwin, 2002). So-called "journal focused" users look for specific journals, use them to keep up-to-date in their field, and log on to an online journal system every time new issues of their favored journals are loaded.

The article model (or "separates" model) is quite different. Aggregators (either publishers such as Elsevier Science or second parties such as BioOne, LexisNexis, OCLC, or ProQuest) take articles from print or electronic journals and make them available in large multititle full text databases. Readers use a search engine to search for and identify articles of interest to them and they read the specific articles out of the context of a complete journal. Pullinger (1999) has called these readers "topic-focused" if they search for articles without limiting to specific journal titles or "article-focused" if they seek to retrieve known articles from a specific journal title. Topic-focused readers likely read articles from a much greater variety of journal titles than do journal-focused or article-focused readers, as found by studies conducted by the OhioLink state consortium (Diedrichs, 2001).

A variation on the article model forgoes the first step of publishing in a traditional journal. Authors go directly to an e-print service (such as arXiv.org in Physics or NCESTRL in Computer Science) and post their research papers on this site or post papers on their own or institutional Web site (Pottenger, Callahan, & Padgett, 2001). As with the more traditional article model, readers may rely on a search engine to locate individual articles of interest to their research and the articles are read out of the context of a bundled collection of material that a journal provides. Adoption

of e-print servers varies with workfield, with high-energy physicists notable early adopters (Kling & McKim, 2000). Alternatively, readers may go directly to a known author's Web site to read separate articles by that author or to a university's collection of faculty articles in a standard format such as that promulgated by the Open Archives Initiative (Pottenger et al., 2001).

*The Importance of the Journal Model.* Research by Amin and Mabe (2000) reveals why, in an age that offers both print and electronic publishing, authors choose a particular journal in which to publish. The reputation of a journal within its discipline and its reach to the scientific community are important considerations, in addition to factors such as timeliness and responsiveness to authors. These findings echo earlier studies, in a print-only world, by Kochen and Tagliacozzo (1974) and King, McDonald, and Roderer (1981). "Prestige" of the journal is an important characteristic mentioned in all of these studies. Clearly authors have long considered the journal as a branded bundle, where presence within a high-quality journal title lends cache to a research article.

ISI's "Journal Impact Factors" are another important quality factor for authors, editors, and scholars. (See Mabe & Amin [2000] for insights into how Journal Impact Factors are used and misused.) Journal Impact Factors cannot exist without the concept of "journal title," as an impact score is calculated for each title in a field based on the number of times articles in that journal are cited, divided by the total number of articles published in the journal each year. Many authors seek to publish in journals with high impact factors and scientists in some countries are given bonuses when they publish in these prestigious journals.

Much of the research to date has focused on the importance of journal articles to researchers' work, rather than the importance of an entire journal. Exceptions are the periodic studies of the number of personal subscriptions held by scientists. In his 1974 book, Meadows examined the studies through the early 1970s that discussed personal subscriptions of entire journals, concluding that scientists subscribe to major journals they read regularly either in their research field or general periodicals like *Nature* or *Science*. More recent studies show a decline in the number of journals that scientists subscribe to on the average, in direct relationship to the increase in journal prices (King & Tenopir, 2001; Tenopir & King, 2000); however, the purchase of full-text separate articles by individuals did not affect their use of print journals.

The number of personal subscriptions has decreased steadily over the last few decades, as the price of scholarly journals has increased. In the past, North American scientists subscribed to an average of six journals each. By the late 1990s this had declined to just over two and the downward trend is continuing. (In contrast to the trend, medical faculty in a recent survey still maintained an average of 6.3 subscriptions per scientist. Two-thirds of all

of their readings are from their personal subscriptions, both electronic and print; Tenopir & King, 2001.) As the number of subscriptions goes down, scientists rely more on library subscriptions and on separates, from electronic full text databases, paper reprints from colleagues or authors, interlibrary loan, or document delivery services (Tenopir & King, 2000).

OhioLink, a large library consortium, offers hundreds of scholarly journals to academic libraries across Ohio. They report that many of the journal titles provided electronically as separate articles were never subscribed to by the libraries that now access them. OhioLink research has found that when such journals are available to faculty and students electronically, the number of journal titles from which they read articles goes up. Beyond those journals considered core to a particular subject, if made readily available, scientists and students read from a variety of sources (Diedrichs, 2001). Recent data from the NorthEast Research Libraries Consortia, however, suggests that the amount of reading from titles that libraries do not subscribe to in print may be less than that found in the OhioLink libraries, with a majority of electronic readings coming from journals that the libraries already subscribe to (Davis, 2002b).

*What Libraries are Doing.* Libraries are spending an increasing amount of their overall materials budgets on serials and an increasing amount of their serials budgets on electronic journals (http://www.arl.org/scomm/lmbs/lmbs2001.html; http://www.arl.org/scomm/mellon). Some of these are journal model products, such as JSTOR, Project Muse, and SpringerLink. Many are article model databases, such as those from ProQuest, LexisNexis, Ovid, and OCLC. Some combine elements of both, such as ScienceDirect from Elsevier Science. Since budget constraints do not allow much duplication, many libraries are replacing print subscriptions with access to electronic journals. Although libraries have always maintained access to both journal and article models in print collections (Indexes and Abstracts provide access at the article level; journal subscriptions provide access at the journal level), electronic collections are more heavily weighted towards article models. Some libraries also provide links to e-print servers. The PrePrint Network, created by the Department of Energy, Office of Scientific and Technical Information, provides access to many disparate e-print servers (http://www.osti.gov/preprint/).

Right now, librarians make the choice whether to purchase a journal model or article model, as both are widely available. If a library changes from a journal model to an article model for electronic journals, will all of the needs of all scholars still be met? Are we, as a recent cover story in *Library Journal* suggests, in the midst of a revolution in scholarly publishing that means the old models are no longer valid? (Albanese, 2001). Many models will be used and tested—only research (and time) will tell what the effects will be on authors, readers, libraries, and, ultimately, on scholarship.

*Research Methods For Studying These Questions*

Studying the potential effects of changes is a challenge and necessarily must include an element of forecasting. Past research into preferences or journal use can provide some insights into possible methodologies for studying this phenomenon. Two main methodologies have been used to date: 1. surveys to determine preferences of individual scholars, and 2. building prototype electronic journal systems to measure usage and preferences.

Tenopir & King (2000, 2001) have surveyed nearly 15,000 scientists and social scientists since the late 1970s to discover a variety of reading variables, including how much they read, characteristics of what they read, what value they get from journal articles, and how much time they spend reading. Questions in the earlier surveys focused, of course, on reading of print-on-paper articles, those from the mid-1990s to the present also include questions to differentiate print and electronic journals. Brown (1999) and others have surveyed faculty within their respective universities to find out how much they read in electronic journals and their preferences for formats.

Surveys can create a statistical picture of current habits and, over time, a picture of how things change, which can provide a basis for forecasting future trends. They can reveal differences in preferences among workfields and workplaces. They show how things change (or do not change) over time. They can also be used to measure preferences and readers' perceptions of and desires for the future, so both qualitative and quantitative data can be collected.

Prototype studies focus specifically on electronic journals and can be used to test preferences for specific search or design features. They borrow methods from both focus group studies and system usability studies. Focus group participants can convey preferences and offer ideas for design features. When these features are incorporated into the prototype design, use can be observed in a natural or controlled environment.

Pullinger's (1999) SuperJournal project is the most recent ambitious prototype study; others done in the past include studies by the American Chemical Society and BRS. (See discussion in Tenopir, 1984.) Several measures can be made in prototype studies, including measures of opinions, preferences as measured by use, and other usage patterns within the prototype system. Both qualitative and quantitative data can be collected as users are studied in an experimental setting.

Research methods for studying issues surrounding the impacts of various models for electronic journals include surveys, experiments, and observations. These methods yield both quantitative and qualitative data. Qualitative data will give a picture of user preferences, opinions, and forecasts of future behavior. Quantitative data provide information on use, usage patterns, and changes under experimental treatment. Together, qualitative and quantitative studies can provide insights into how journals are now used and will be used in the future. These insights will help us under-

stand the implications of collection development decisions by librarians and publishing decisions of both publishers and authors on scholarship.

## Question 3: Intermediaries—Are Librarians—As Intermediaries to the Search Process—Still Necessary in a Digital Age?

*Why This Question Is Important*

The articles model of electronic journals relies on effective search strategies entered into reliable online systems. Since the early days of online searching in the 1970s, researchers have studied search strategies, first of expert searchers and later of novices, and observed the interactions of search intermediaries and their clients. These studies have aimed to develop optimal search strategies and procedures that could be incorporated into online systems to make them easier to use and build on the many decades of studying how reference librarians interact with library patrons.

It may seem odd to place a phenomenon that has been studied for so long on a list of research topics for the future, but researchers have reached the point with this topic that they are able to build on a firm foundation and compare future research with an accepted body of research from the past. This is not always the case with library and information science research topics.

The ultimate goal of many information retrieval system designers is to create a system that will be so user friendly and "intelligent" that it can be used independently, so users can answer their information needs with a minimal amount of assistance. (Drenth et al., 1991). The intermediary may not often conduct an entire online search for a user anymore, but even the traditional helping roles of the reference librarian are being questioned in a digital environment. Many users search online without seeking help from a reference librarian and spend many hours on the Web without ever considering asking for assistance.

Even if human assistance is no longer being sought by many users, librarians need to understand what, if anything, a human intermediary or reference librarian contributes to the information search process, which of these contributions can be captured in system design, and which must remain an individualized human process. We need to understand which of these contributions can lead not only to better systems and better library services, but also perhaps to justification for funding librarian services.

*Previous Work*

The literature review here is not comprehensive, due to the vast quantities of articles on this and related topics. Several review chapters in the *Annual Review of Information Science and Technology (ARIST)* (see, for example, Bates, 1981; Borgman, 1984; Harter & Hert, 1997; Drenth et al., 1991) and an early literature review by Fenichel (1980–81) describes in depth

related research literature on topics of search strategies, online system evaluation, and expert system design. Lynch (1978) studied the reference interview process in public libraries in a mostly preonline era, and Bunge reviewed the traditional reference interview literature in 1984. The current discussion includes only some of the studies that specifically address the contributions of the intermediary in the online searching process.

*Seminal Work.* Even a limited discussion of this topic must include mention of several seminal studies that form the basis for much of the work that came after them. Most modern studies of the intermediary-client interaction point to Taylor, who, in 1968, differentiated between when users seek information on their own and when they approach a librarian. Asking for assistance usually only occurs late in the search process, and reference librarians are skilled at using questions as filters to elicit the information needed to understand an information need.

Bourne (described in Hawkins, 1982) was one of the first to observe strategies of expert online searchers, placing strategies into several broad categories. Citation Pearl Growing, Building Blocks, Successive Fractions, etc., are now recognized general approaches to searching that have been tested and extended by Bates and others (Hawkins, 1982).

In 1979 Bates developed a set of search tactics that are used to record and measure specific steps used in online searches of standard Boolean-logic based systems. Soon after, Fidel (1985) empirically developed a set of operational and conceptual moves used by intermediary online searchers. These specific moves and tactics are still used today to measure search strategies by both novices and information professionals. Having two accepted measurement scales makes research easier to conduct and to compare, so much of the research on search strategies conducted from the 1980s on uses the work of Bates or Fidel.

Borgman (1989) examined in depth how individual differences and human characteristics influence choice of search strategies. Borgman found that the time to reach success in computer-related tasks, such as online searching, has a much larger variance than in other types of tasks. Technologically inclined people are able to complete search tasks much more quickly than others and have fewer problems with search techniques such as Boolean logic. (An entire branch of information science research has evolved around the human factors study of the cognitive side of information seekers [see Ingwersen, 1999; Pettigrew, Fidel, & Bruce, 2001]; it is much too broad to review here.)

*Questioning.* The questions asked by both users and intermediaries, and how they are asked, have been shown by many researchers over time to be a crucial factor in the search process and search success.

Some early important studies of the human aspects of interaction with information systems show why questions are so important. Belkin (1980) observed that users approach a system due to a gap in their knowledge.

Belkin expressed this as ASK—anomalous states of knowledge—and demonstrated that it is difficult for users to express an information need or ask a question when they have such gaps in their knowledge or understanding. Human intermediaries may, through the reference interview, help users get to the point where the ASK can be resolved, but online systems do not yet do this very well (Belkin, 1980; Belkin, Oddy, & Brooks, 1982).

Information seeking online involves a range of human capabilities, including the cognitive, affective, and sensori-motor domains (Nahl & Tenopir, 1996; Wang, Hawke, & Tenopir, 2002). All three domains interact and influence each other. Most systems and documentation confront only the cognitive and sensori-motor domain questions (e.g., how do I conduct a search and what button do I push?). Human interaction can better address the affective domain (e.g., will I make a mistake?) than help screens or documentation do. The role of each domain has been identified in studying questions asked during the search process.

Nahl and Tenopir (1996) and Tenopir, Nahl-Jakobovits, and Howard (1991) found that novices ask many questions when they are searching for information online, and, when no intermediary is present, most of these questions are never verbally expressed. Using the technique of protocol analysis, the researchers tape-recorded novice faculty, undergraduates, and graduate students while they searched for information in a general interest full-text periodicals database. Participants were instructed to "think aloud" as they proceeded, voicing their internal thoughts. Analysis of the transcribed recordings revealed that, on the average, novices had many questions per search, an average of eleven moves per search (as measured by Fidel's categories). If a reference librarian had been nearby (or available online), at least some of these questions would likely have been asked and answered.

Questions may get verbalized when a human intermediary is present. Wu (1992) recorded the many questions asked of intermediaries by search clients both in the presearch interview and, more frequently, during the search. Although no one session contained all categories of questions, Wu observed nine categories of questions (elicitations), including questions related to: search terms, search procedures, databases, output, and other information services. Both Wu (1992) and Nahl & Tenopir (1996) observed a high percentage of reassurance questions (called "echoic" by Wu and "rogering" by Nahl & Tenopir)—questions that needed no answer (for example, "are you sure?"), but are basically part of the affective side of human interaction.

The interaction between an intermediary and a client can take on many dimensions. Spink, Goodrum, and Robins (1998) studied interactions both in the presearch interview and during the search session. They found that intermediaries requested fifteen different types of information from their users, including requests for information about search strate-

gy and terms, output (relevance), domain knowledge, and database selection. (Wu, 1992, and Nahl & Tenopir, 1996, examined the other side of questioning in this process—the questions posed by end users during the search process.)

Spink et al. (1998) studied interactive feedback between intermediaries and academic clients during presearch interviews and online searching sessions. Data collected and analyzed included videotapes, transcripts, online searching logs, and relevance judgments by the users. This gives a good picture of the various types of interaction that occur between an intermediary and a client during a search and shows how rich that interaction can be. Spink discovered a total of 885 interactive feedback occurrences in 40 mediated online searches, with a mean of 22 per search. She further categorized these occurrences into five types: content relevance feedback, term relevance feedback, magnitude feedback (size of output from a query), tactical review feedback (display the search strategy history), and term review feedback.

White has studied the reference interview over time (1985, 1989, 1998). In her 1998 study she found that the information specialist dominates the presearch interview, but both clients and intermediaries tend to ask short-answer questions that are mostly focused on the subject, search strategy, the service, and the output. The most common types of questions were verification questions (approximately half of all questions). Verification questions are similar to the echoing or rogering questions so commonly held by users, in that the questioner already knows a supposed answer, as opposed to questions that elicit totally new knowledge.

Several researchers have studied how different types of questions posed by reference librarians influence the satisfaction and perceptions of users. (See, for example, Auster & Lawton, 1984; Allen, 1988; Dervin & Dewdney, 1986; Dewdney & Mitchell, 1997; and Radford, 1996.) Findings show that, although both open-ended and closed questions are asked during the interview process, users are more responsive to open-ended questions and questions that probe into why something is needed, rather than close ended or simply factual questions. Spink et al. (1998) observed "complex interactions" between users and intermediaries throughout a search session.

Whether the questions are posed by an intermediary to a user or from a user to the intermediary (or are merely in the minds of the users), the online research process is one in which numerous spoken and unspoken elicitations occur. Robins (1998) found that the mediated online search process is highly interactive and that intermediaries and users work together in a nonlinear interplay both during the presearch interview and during the search. The search topic even changes focus on the average approximately every seven utterances. Systems today do not yet recognize this important interaction. More research is needed on the effect question asking and question answering have on the success of online research and on the satisfaction levels of users.

Most of the studies mentioned above tape-recorded interactions, with the researchers working from transcripts of these recordings. Transaction log analysis is another method for gaining insights into the searching behavior of novices. Many researchers in the past decade have analyzed the transaction logs from searches of library catalogs, commercial online systems, or Web search engines. (See for example, Hunter, 1991; Peters, 1989; Zink, 1991; Saracevic & Kantor, 1988; and Spink et al., 2001.) Wallace (1993), for example, examined transaction logs of the online catalog from public access terminals at the University of Colorado libraries. She found variability in the amount of use the search aids available on the system. Quick search and express search features were used rarely; search history and searching other databases were used more extensively. Catalog users prefer to search for natural language keywords and then scan lists of titles.

*Information Overload.* These studies show that intermediaries help answer factual questions, provide reassurance to affective questions, and help users clarify their information needs. Another role that librarians as intermediaries play is to help users select the best resources and overcome information overload. Information seekers today are much more likely to find too much on their topic rather than too little because most of our online systems are better at locating lots of information than locating only the best information. Extensive studies of Web search behavior by Spink, Wolfram, & Jansen (2001) found that average users of a Web search engine enter only a little over one term per search and review only the first page or two pages of the results. This either means that the relevance ranking algorithm in the Web search engine works so well that the users find everything they need on the first screen or, more likely, they are overwhelmed by the thought of going beyond twenty or so items and decline to delve more deeply.

Many librarians have called for reference librarians to help end users sort through the vast quantities of information to locate the best sources for their needs (Hopkins, 1995; Rice, 1989; and Biggs, 1989 for example). Hopkins suggests several possible ways this might be accomplished, including quality filtering by ranking by citation counts or citations in review articles, structured guides to the literature that include quality judgments, and better information literacy instruction.

*Teaching Search Strategies.* User instruction is another traditional role of reference librarians. Many librarians have commented on the increased need for instruction with the prevalence of independent end user online searching (see for example, Tenopir & Ennis, 1998). Mercado (1999) surveyed how instruction programs have changed and recommended that library users need to be taught not only how to search, but critical thinking skills. Beyond the specific techniques of systems, librarians are finding that students need to know overall search approaches and how to choose which databases to search.

Developing search strategies is not a natural skill. Taylor and Penhale (1998), for example, found that, even after instruction, students at Earlham College still needed librarians to help them devise and refine complicated searches. Students may have unrealistic expectations of their searching ability and what information they can find on their own. Librarians, through instruction and real-time assistance can help inject some reality as well as skills (Tenopir & Ennis, 1998).

Searching is more of an art than a science, however. Saracevic and Kantor (1988) studied search strategies used by experienced searchers on the same topics. They found much variation in the terms selected for searching and the search formulations. Critical thinking skills, rather than the one best way to search, will help make more independent searchers, but intermediary assistance can help users think about alternatives.

*Research Methods For Studying These Questions*

Information professionals play many roles in the search process, not only that of an intermediary conducting a search for a client. The roles of question-answerer, affective reassurer, instructor, presenter of alternatives, and quality filter have all been found to be a part of search success. Most of the research into these roles and the effect on search success can fit under the general heading of "user centered" research. The methods and methodologies of user-based research are well defined and described by Wang (2001).

Observations, protocol analysis, and transaction logs together provide a baseline of mostly qualitative data. In the future, additional observational studies will build on past research, but observations should be combined with experimental techniques. Observational studies generally rely on qualitative data and are often described as "preliminary" or "exploratory." This is appropriate when a topic is new, but now that specific factors and behaviors have been observed and measures developed, traditional experimental techniques can explicitly test these factors.

In the future, we need to discover in more depth how search behaviors vary with different intermediary behaviors and with systematically introduced variations in help screens, real-time online help by librarians, and documentation. Similarly, user satisfaction and the effect on the intellectual output of students and scholars should be measured against the introduction of different treatments in the mediation process. With such a rich baseline of exploratory studies, it is now time to produce more definitive experimental work.

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# Research Questions for the Digital Era Library

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## ABSTRACT

THE CHANGING INFORMATION ENVIRONMENT and the changing expectations and demands of library users are forcing libraries to reassess their role in the digital age. Amidst this change there is a fundamental constant—the need for access to high-quality research materials. Success in the new environment will require learning much more than we now know about the use of digital resources, their preservation, and the training needed for operating the library of the future. This article examines three essential questions and suggests areas for research in each:

1. How are digital resource users best served: What resources will they want? How will they want to use them? And, what services will most enhance use?
2. What elements are required for a coherent preservation strategy covering resources both digital and traditional?
3. What kinds of education will "librarians" of the future need?

## INTRODUCTION

What is a library? This seemingly simple question underlies all the others I pose in this essay. It is important to ask what shape and form the library may assume in the digital age because many observers question whether the traditional library can move into the new environment successfully. Librarians have been challenged to imagine a library that does not demand that the user come to it physically to take advantage of its services. In response to that challenge, they have actively promoted a vision of a library that allows faculty, students, and the broader public to identify and use

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 636–651

needed information wherever they happen to be and at any time. Yet, the reality of moving to something more fluid than a physically bounded space, containing collections built in response to local demands, is harder to deal with than most librarians care to admit. Libraries have begun to serve audiences unknown to them, but these new patrons' appetites for electronic resources seem hard to satiate.

As librarians think about users who are not part of their traditional constituency, they increasingly ask—Whom do we serve? And, what exactly do we offer them? Local libraries have unique cultures. Local librarians have worked hard to learn the preferences, special needs, and requirements of their users. Collections have been built with care and attention reflecting the close connections that exist between the library and those who depend upon it for information, insight, and pleasure. Adding a layer of users we do not know—and probably never will—raises important new questions about libraries' roles and responsibilities.

Most people have long viewed the library as an unchanging organization. For them, it has been the same place for the past hundred-plus years—an authoritative repository of information resources. However, digital era patrons have different expectations. They are not necessarily interested in the authority exercised by the library in building good collections. Increasingly, we hear from faculty that today's students are interested in digital resources only. Convenience, and the ability to retrieve information on one's own rather than relying on help from librarians, are exceedingly important attributes of digital information according to students. Faculty members spend considerable effort in trying to persuade their students to go beyond the computer screen to find materials of value for thinking through important issues in their studies. But, we have learned from paying close attention to use patterns in a variety of institutions that for younger users especially, and increasingly for all users, the importance of an authoritative physical institution is decreasing. Librarians know the great value of curated print, but new generations of information seekers place higher value on convenience and speed than on carefully assembled and authoritative print collections. If libraries are expected to change from purely physical places to hybrids with both print and electronic resources, and eventually, we assume, to collections largely digital, they must assess their ability to make the change and become abstract, virtual entities.

But amid the rapid changes, there is one constant—the need for access to high-quality research materials. Faculty members need librarians' support in finding new ways to make connections between the user and the materials that will facilitate intelligent inquiry and the creation of new knowledge. How will librarians provide this traditional service in the new environment? Can library services be restructured to present high-quality, trusted information in digital form to meet the needs of users for truly useful material as well as for immediate, convenient access?

That is the context within which we must consider particular needs for research. Reflection on these broad questions suggests to me the need for three lines of research in particular. Success in the new environment will require learning much more than we now know about the use of digital resources, their preservation, and the training needed for operating the library of the future. More precisely, the essential research questions may be stated as follows:

1. How are digital resource users best served: What resources will they want? How will they want to use them? And, what services will most enhance use?
2. What elements are required for a coherent preservation strategy covering resources both digital and traditional?
3. What kinds of education will "librarians" of the future need?

## Research Question One: How Are Digital Resource Users Best Served?

*A. Why is it important?*

Academic libraries have routinely conducted surveys of their users to determine how many people come through the front door, how many gain access to electronic resources from their dorm rooms or from home, and how many believe that they receive adequate and timely answers to their questions. Unfortunately, there have been few studies that ask broader and, I would argue, more meaningful questions, such as the following: How do users identify the information resources they need? What sources continue to provide information needed by the user? To what extent do users feel confident that resources they have identified for their particular purposes are best? Are users equipped to assess the utility and quality of the resources they use? To what extent do they rely on library-validated information?

Popular media and librarians alike report that students turn first to the Web for their information needs. What they find there may well be provided by the local academic library. But, do the students understand that? Their belief that they can find what they need through their personal computers adds to the difficulties librarians have in justifying their collections budgets to their administrators. During this transitional period in which libraries are responding to users' needs by supplying both print and electronic resources, it is critically important to understand the changes in information seeking behavior and to think carefully about the implications of this change for library services and collections.

*B. Previous research*

We are beginning to recognize the importance of understanding the needs and information seeking behavior of users of digital as well as of traditional material. In a recent study of twenty-four large institutions that

Denise Troll Covey undertook as a Digital Library Federation (DLF) Distinguished Fellow, she found that users want libraries to offer a seamless presentation of collections and services regardless of where, by whom, or in what format they are managed. She found also that users want technologies that enable them to bring these materials together into synthetic wholes for particular purposes. Users need to identify appropriate digital materials, combine new resources with their own digital files, and make use of these combined formats in research papers, classroom work, and multimedia presentations (Troll Covey, 2002).

To learn more about use, users, and the usability of digital library collections and services, Troll Covey worked with DLF members to identify an agenda for research, development, and information sharing. They identified the following specific lines of research and development needed under three broad categories:

*1. Research methodologies and their application in the digital library context.*

- Identify, evaluate, and determine the potential shared application of quantitative and qualitative research methods appropriate for evaluating the nature, extent, quality, and effectiveness of the use and usability of digital collections and services.
- Encourage commercial vendors and local developers to apply whatever is learned from use and usability studies in the design and development of digital library collections, services, and applications.
- Encourage application of whatever is learned from use and usability studies in the development of user support services and in professional development activities (e.g., for public service librarians).

*2. User support in a 24/7 digital library.*

- Identify communities that use physical as well as digital libraries.
- Conduct an environmental scan of current practice, and then identify, evaluate, and determine methods appropriate for delivering public service functions and user support in a 24/7 digital library service environment.
- Contribute to the development of performance measures, best practices, and knowledge management appropriate to 24/7 user support services.

*3. The library as space.*

- Study the use of the library as both a physical and virtual place.
- Identify social interactions in the physical library that are not currently possible in the digital library, determine which social interactions are essential to the mission and values of a library, and investigate ways to support these interactions in the digital library environment (Greenstein & Troll, 2000).

As the DLF committee observed, these three research areas are interrelated:

> The research methodologies developed to evaluate use and usability of digital collections and services (area 1) will inform strategies for supplying user support in the 24/7 digital library (area 2) and decisions about the use of library space (area 3). Similarly, investigations into the use of library space (area 3)—for example, the study of social interactions—will inform the development of 24/7 support services (area 2) where such interactions may also be encouraged, albeit in an online environment. (Greenstein & Troll, 2000; Troll, 2001)

Libraries are challenged to design measures of user behavior that help them make good decisions about what materials should be added to collections that support users' research and inquiry needs. Unlike old measurements that had more to do with the size of collections and number of transactions, new measures must yield information about where and how users find the resources they need, measures that have nothing to do with physical collections in a particular institution. The Association of Research Libraries, in its E-Metrics and LibQUAL+ projects, is developing tools that its members' libraries can use to assess their programs and services as an alternative to the traditional quantitative methods.[1]

In 2001, the Council on Library and Information Resources and the Digital Library Federation commissioned Outsell, Inc., a commercial research firm, to conduct a survey of changing patterns of library uses in universities and colleges. Outsell was charged to collect data on how both students and faculty in all types of academic institutions use internal and external information resources. To provide a large enough sample for statistical significance, Outsell conducted interviews with 3,234 randomly selected students and faculty members. The results, published in November 2002 (Friedlander, 2002), help us answer questions about how users identify information they need, where they look for that information, to what extent they rely on information resources provided by libraries, and to what extent they seek information elsewhere.

The data from Outsell indicate that comfort with digital resources among students and faculty is almost as great as with print, but that library use is changing rather than diminishing. Questions now arise about how much responsibility any one institution has for producing, preserving, and managing digital resources that can reach every computerized community.

*C. Suggestions for additional research*

Beyond the studies by Troll Covey and Outsell, continuing research into the use will be needed because the proliferation of Internet-based information is fundamentally altering the expectations, behaviors, and preferences of library users generally. Such studies will help us define the library of the future by illuminating what collections and services users want and expect from libraries within the larger constellation of networked information and service providers.

In producing its report for the DLF, Outsell collected massive quantities of raw data through interviews; significantly, the respondents were not chosen from known library users. To gain insights into the real value of the Outsell-collected data, other researchers should be invited to pose actual problems to which the raw data can be applied. In addition, other types of libraries—community college and public libraries, in particular—should be encouraged to undertake similar types of surveys of their users. CLIR has deposited the Outsell data with the Inter-University Consortium for Political and Social Research (ICPSR) so that all researchers will have access to them.

## Research Question Two: What Is Needed for a Coherent Preservation Strategy in the Digital Age?

*A. Why is it important?*

To develop a coherent strategy for the preservation of library materials in an era when new kinds of materials are being created electronically, librarians need research along several lines. We need continued research to improve the preservation of traditional materials. Also, we need new research into the preservation of digital resources, both those that contain reformatted traditional materials and those created digitally. I do not treat these lines of inquiry as individual research questions because digital and traditional preservation must be looked at together if we are to have effective and affordable preservation programs in the future. In connection with both, we need research into the status of programs that provide preservation in college and university libraries, and how best to encourage and develop these programs.

Let us look first at the national preservation situation. The 1980s and 1990s witnessed a nationwide movement to preserve endangered library and archival print material. This activity was spurred by concerns about the vulnerability of paper-based materials from the past 150 years and by the ready availability of resources for preservation from government and private foundations. In 1989, the National Endowment for the Humanities (NEH) launched its nationally coordinated programs to preserve the intellectual content of U.S. newspapers and brittle books through preservation microfilming. Organizations such as the Association of Research Libraries (ARL), the American Library Association (ALA), the Commission on Preservation and Access, the Council on Library Resources, the Library of Congress, and the Research Libraries Group (RLG) exerted national preservation leadership. They articulated a vision and created an advocacy campaign to promote preservation awareness, which led, among other things, to the gathering of annual preservation statistics and the increased use by publishers of acid-free paper. By the early 1990s, most research libraries had established full-fledged preservation programs.

By the end of the 1990s, however, there were growing concerns that these programs were themselves at risk. ARL annual preservation statistics showed that as of 1999 preservation expenditures had remained flat for the previous seven years, and that the number of staff members assigned to preservation had reached a ten-year low (Reed-Scott, 1999). Yet more recent ARL surveys on preservation suggest a more positive picture, indicating that staffing levels have risen and that funding has grown or stabilized. (ARL, 2000; Young, Kyrillidou, & Blixrud, 2002). There are uncertainties in many libraries about the relationship of preservation to digital resource developments. While library directors continue to identify traditional preservation as a key concern, new demands, particularly in the digital domain, often compete with preservation for resources, and receive them from internal reallocations. Outside funds available for preservation have diminished as government and private foundations experienced declines in appropriations or changed their program priorities. For example, the multiyear effort through which the NEH hoped to finance the microfilming of 3 million brittle books has failed to keep pace with projections, in large measure because of a sharp cut from which the NEH budget has struggled to recover. Many preservation programs have been initiated with outside funds, and many remain to one or another degree dependent on soft money. Preservation education programs and regional preservation centers also remain dependent on outside resources.

Within the library profession, uncertainties are underscored by the lack of a clearly articulated vision for preservation in the digital age, a decline in effective national leadership for preservation by professional organizations, and a dwindling pool of qualified candidates for top administrative posts. We greatly need to know how this state of uncertainty and flux is affecting the ability of individual libraries to continue their indispensable preservation functions.

Preservation of books has been an important concern of librarians for decades, but the preservation of digital resources raises important and urgent issues. Books and manuscripts may be discovered decades after their publication and are still readable, even if the paper is fragile. Digital information, however, cannot be read in even a few years if the creator did not have the foresight to include information about the hardware and software used to create the content. For the first time, the decision to preserve must be made at the point of creation. This requirement creates new problems for librarians, and requires new research.

*B. Previous research and suggestions for additional research*

Research has been conducted in a number of preservation-related areas. It is useful to break the larger question of what is needed for a coherent preservation strategy into a few subthemes, and describe the work that has been done and needs to be done in each area.

*Preservation Research Subquestion 1: What is the State of Libraries' Preservation Programs?* With support from the Institute of Museum and Library Services (IMLS), four organizations—the Council on Library and Information Resources (CLIR), the Association of Research Libraries (ARL), the University Libraries Group (ULG), and the Oberlin Group of libraries—joined forces to conduct an examination of the state of preservation programs in American libraries. Using both quantitative and qualitative evaluation techniques, the authors of the study have made what they term "a first attempt" to "establish benchmark data for subsequent longitudinal comparisons," through which researchers will be able to provide greater insight in the future (Kenney & Stam, 2002). Here are some of the issues that the study set out to investigate:

*Library trends:* Preservation programs need to be considered in the context of recent trends affecting American libraries. ARL member libraries report a 12.5 percent drop in circulation since 1995 and a significant decline in purchased volumes (26 percent for monographs and 6 percent for serials) since 1986. Members of the Oberlin Group, however, report consistent rises in both acquisition and physical circulation.[2] What accounts for these differences? And, how do such figures correlate with core preservation activities such as binding, preshelf processing, and book repair? To what extent are preservation and access activities intertwined?

*Digital development:* Libraries of all types report significant growth in digital acquisitions and conversion, but few have developed adequate digital preservation strategies, according to Margaret Hedstrom and Sheon Montgomery in their report, *Digital Preservation Needs and Requirements in RLG Member Institutions.* What is the role of preservation programs in shaping institutional policies for digital preservation? Has there been a shift in preservation resources to meet these needs? How are analog and digital preservation activities related to one another?

*Aging assumptions:* In 1991, ALA issued a Preservation Policy, and that same year, ARL published preservation program benchmarks for selected core activities (Merrill-Oldham, Roosa, & Morrow, 1991). Are these policies still valid, given the changing circumstances of ownership and access? Similarly, does the brittle books strategy developed in the 1980s remain the best approach? Are we making sufficient progress? Employing an ample range of technologies? Is the brittle books program still viewed as an important preservation imperative?

*National leadership:* What are the pros and cons of developing a national preservation plan for the digital age? What is needed to revitalize preservation leadership by national professional organizations?

*Education and recruitment:* Why are institutions finding it difficult to attract top professionals to preservation positions? What is the state of preservation education in library and information studies programs? How can

the profession help develop preservation leadership skills and the next generation of preservation administrators?

*Collaboration:* Consortial preservation efforts have been heavily dependent on outside funding. To what extent have these efforts enabled libraries to reduce their own preservation expenditures and increase program effectiveness? To what degree are institutional funds devoted to cooperative preservation activities (e.g., shared offsite storage facilities)? Are cooperative efforts more characteristic of certain libraries than of others? Are there any business models for cooperative preservation programs that will promote greater self-sufficiency?

*Economics:* To what extent are preservation programs at financial risk? What strategies for financial sustainability have succeeded for preservation programs in college and research libraries? And, how can they be used elsewhere?

The IMLS-funded State of Preservation study helps us understand how academic librarians are viewing their preservation roles and responsibilities. As a next step, CLIR has begun an in-depth survey of endangered materials, focusing particularly on the audio and visual collections that have been held in libraries but not included in preservation treatment plans or programs.

*Preservation Research Subquestion 2: How Can We Best Preserve Digital Materials?* Research efforts so far have focused on the technical aspects of digital preservation. The National Science Foundation has funded a series of workshops to address research needs. The Internet Archive has hosted several meetings at which individuals from the library, technology, and scholarly communities worked on research requirements for preserving massive Web sites. The Andrew W. Mellon Foundation has funded seven pilot projects in which research libraries and publishers have attempted to work together on requirements for establishing archives of electronic journals. All these endeavors have been important in advancing research on the technical details of digital preservation. But, they also showed that the organizational, legal, and economic issues could be even thornier than the technical issues. These nontechnological issues must be more carefully analyzed in the future.

Although many aspects of digital preservation have received attention since the mid-1990s, most of the presentations and papers on the subject have ended with little more than general comments about the complexity and expense of the tasks, and ambiguity about responsibilities and roles. In December 2000, the Library of Congress received a congressional addition of $100 million to its budget to finance the development of a national strategy for preserving digital information. This news was welcomed in a library world badly in need of such leadership. Following the recommendations of a National Advisory Board established for the project, the Library of Congress commissioned papers on the challenges (technical, organizational, and financial) of preserving digital content in six formats: large

Web sites, film and video, recorded sound, digital television, electronic books, and electronic journals. These papers provided the context for a series of meetings that brought together librarians, archivists, scholars, technologists, content creators, producers, and distributors to discuss digital preservation priorities and strategies. The discussions informed the development of a national strategy that was accepted by the Congress in 2003.

From the Library of Congress project, research questions are emerging such as the following:

- What kind of technical infrastructure will be needed to support a network of repositories for the preservation of digital information?
- How will materials to be preserved be selected?
- What are the legal barriers to preserving digital information?
- How do requirements differ for preserving information in different formats?

Numerous individual projects are yielding interesting results, but there remains much more to learn about these questions.

High-level architectural principles have been established, and they appear to be promising. However, considerable work is needed to translate the principles into an established system if there is to be an operational repository of preserved digital information. The job to be done is highly technical, and it is urgently needed.

Additional work is needed to identify the types of born digital materials that will be selected for long-term preservation. The Library of Congress has a long and rich legacy of collecting primary source materials in all formats. That concept of universal collections must be translated to a distributed, digital environment.

*Preservation Research Subquestion 3: How Best to Improve the Preservation of Traditional Materials?* We are unlikely to digitize every book, journal, manuscript, artwork, film, photograph, videotape, and sound recording in the general and special collections of the nation's research libraries. Not only would this be prohibitively expensive but also demand for many items is sufficiently low to make expenditure on digitization far less than necessary. At the same time, many items that we have digitized have been "rediscovered" by scholars who want to see the originals in addition to having digital copies. Finally, we want to keep many things as originally created—rare books, signed manuscripts, original images—because of the historic, artistic, and financial value of the objects themselves. The preservation of traditional materials must therefore continue even in the digital era, or one might say *especially* in the digital era because no medium is more susceptible to media decay and loss through obsolescence than the tapes and disks containing magnetic bytes and bits.

Preservation of original "artifacts," however, continues to raise problems. Books printed on wood-pulp paper through a process widely used

since the 1840s continue to "brittle"; that is, chemicals from the process interact with heat and humidity to make the paper destructively acidic. The funding initiative begun in 1989 by the National Endowment for the Humanities to microfilm three million deteriorating books in research libraries continues but remains far short of its initial goal. In the meantime, original estimates of the rate of acidic paper deterioration have been questioned, and experiments have begun with such alternatives to microfilming as mass deacidification.

Similar needs confront us for the preservation of audiovisual materials. Anyone who has left family photos on a piano close enough to a window to receive the sun's full glare knows how quickly their images and colors fade. Old photos made with nitrate film are even fire hazards. And old recording media, such as wax cylinders, acetate platters, and flimsy tape, easily break. Moreover, even if the library has perfectly preserved study collections of films, videos, and audiotapes of historic events, artistic performances, natural phenomena, exotic cultures, oral history interviews, and whatever else scholars at one point or another have brought in from field trips and studios, many will be inaccessible unless the library has also kept all the original recording equipment in working condition or has transferred the material to preservation film and tape that can be played with today's technology. Studies sponsored by the Library of Congress, the Council on Library and Information Resources (CLIR), and others have documented the risks facing huge quantities of analog, audiovisual material.

Money is needed to meet these needs, but so is research. In November 2001, CLIR issued a major publication on preservation, *The Evidence in Hand: Report of the Task Force on the Artifact in Library Collections* (Nichols & Smith, 2001). CLIR had convened a task force, composed of scholars, librarians, archivists, and academic administrators, to consider questions about preserving original (that is, unreformatted) library materials in the digital-information age. The report analyzed issues in a way designed to help research repositories answer these questions:

- What qualities of an original are useful or necessary to retain in their original form? Under what circumstances are original materials required for research?
- When is it sufficient and appropriate to capture intellectual content through reformatting and not necessarily retain the original?
- Which preservation options provide the most appropriate and cost-effective means of preserving the original?
- From both custodial and scholarly perspectives, what are the advantages and disadvantages of these various preservation options?

The report also laid out a set of recommendations for future research that included the following:

- Gather data on the state of artifacts in nonacademic libraries and repositories.
- Research and develop curricular needs for the use of original sources.
- Increase media longevity studies and extend them to all new media, including digital. (Nichols & Smith, 2001)

Some light has been shed on the state of artifacts in nonacademic libraries and repositories by the IMLS-funded study on the status of library preservation programs. The user studies described earlier have shed light on the need for use of original sources. It remains here to emphasize the third item posited by the task force—the need for media longevity studies. In particular, research is imperative to assess anew the rate at which acidic books become brittle and to determine the proportion of endangered books that actually have become useless so that we can be more certain of how much time we have to save others. In addition, we need research to tell us at what rate and in what volume materials printed on potentially acidic paper continue to be produced by publishers. And, we need further, rigorous study of the effects of experimental deacidification techniques—and of storage improvements—on the life expectancy of print materials. Equally important is continued research on improving the longevity of film and audio resources, materials that will be increasingly important for documenting late twentieth and twenty-first-century history.

Finally, because it would be pointlessly expensive to microfilm, let alone digitize, every printed *copy* of every book found to be disintegrating, we need research to get a better idea of how much duplication there is in the holdings of research libraries, and a better idea of how much use of multiple copies is made. We need to study the potential pros and cons of extended collaborative arrangements through which libraries, jointly financing or dividing up responsibilities for services, or even sharing ownership of physical and digital resources, could store, reformat, and meet patrons' needs for library materials more cost-effectively.[3]

## Research Question Three: What Education Will "Librarians" of the Future Need?

*A. Why is it important?*

In 1923, the Carnegie Corporation published a landmark report written by economist Charles C. Williamson. Entitled *Training for Library Service,* the study became the principal guide for the development of professional education in the next four decades. The earlier in-house training programs in libraries largely disappeared as universities embraced this new field of academic study and created schools of library science.

Since the publication of Williamson's report, professional library education has remained in the hands of universities. Yet, in the last two decades,

the state of library education has changed substantially. Many universities, especially those privately funded, have closed their schools of library and information science. Others have incorporated their library science curricula into other, related departments.

Even more important than declining numbers of library schools, those that remain have abandoned their common professional focus. All the schools have changed their names to incorporate the word *information,* recognizing that the profession of librarianship no longer focuses exclusively on libraries and their functions but instead now involves managing information wherever it is collected, transmitted, and used. Graduates of today's schools find employment in the insurance industry, the film industry, the software development business, and other businesses created or transformed by the revolution in information technology.

Seeing this diversification in the professional prospects of their graduates, and challenged by the growth of information science in other schools of the university, library schools have desperately been seeking to redefine their roles and their curricula. The changing idea of information science in the universities has weakened the position of library schools. Many that closed simply failed to accommodate the new interests and meet the new standards of their colleagues in engineering, business, economics, and other disciplines. The remaining library schools are recruiting faculty from all of these departments. A dean of the School of Information at Michigan came to the position after being chair of a computer science department; and before him, the dean had been recruited from Michigan's School of Engineering. A dean of what had been the library school at Berkeley came from economics. Renamed the School of Information Management and Systems, the Berkeley school has given up its American Library Association accreditation because it no longer regards the training of librarians as relevant to its mission.

At the same time that schools of library and information are developing curricula to prepare graduates for a great variety of information related careers, libraries are working to integrate print-based and digital collections and services. The academic curricula must be flexible enough to support many different career tracks, and libraries are but one such track. The particular skills needed in public, academic, or corporate libraries are probably best taught on the job. Many of the large public and research libraries are beginning to understand the need to become teaching libraries if their professionals are to be wholly effective.

Libraries of all types are finding it increasingly difficult to recruit the talent they need. This is happening at a time when the libraries are expanding their role in managing the information resources that constitute the foundation for inquiry, scholarship, and teaching. The Association of Research Libraries reported for 2002 the highest level of director turnover in a couple of decades.

In early 2002, the Institute of Museum and Library Services received a special appropriation of $10 million to focus on the recruitment and training of a new generation of librarians. Although it is premature to describe the influence of this new program, it is encouraging that a federal agency has been charged with addressing the problem.

Also, the Association of Research Libraries and the American Library Association have launched programs aimed at increasing diversity among library and information science students as well as among practitioners. These organizations understand that user needs are most effectively met when the cultures of users are also represented among the information professionals who meet the needs.

The Council on Library and Information Resources has combined forces with EDUCAUSE and Emory University to create a short-term leadership training program aimed at bringing librarians, information technologists, and teaching faculty together to consider the collaboration required in managing today's mixture of traditional and electronic information resources. The work of transforming education and training for librarians of the future must go hand-in-hand with developing new leadership models for managing information-providing organizations that must necessarily emerge in academic institutions.

*B. Needed research*

Clearly, the time has come to analyze more systematically the requirements for librarianship in the future. There is really no previous useful research to build on, but we greatly need research focused on the following kinds of questions.

- What kinds of professionals, with what kinds of skills, will different types of libraries need?
- Are today's schools of library and information science equipped to train the kinds of professionals that libraries will need?
- If not, where will appropriately skilled professionals best be trained?
- What is the relationship of teaching libraries to the graduate programs in information and library studies?
- What should practitioners learn in their on-the-job education?
- What is the expected rate of retirement for those now working in different types of libraries?
- Will the output of schools of library and information science be sufficient for filling vacancies?
- How can leadership positions most effectively be filled in the future?

## CONCLUSION

The three lines of research I have proposed—research into the needs and behaviors of library resource users, into options for preserving such resources, and into requirements for redefining professional librarianship

and training for it—may seem unrelated at first glance. But, as digital technology increasingly influences the functions and services of libraries, these three areas of inquiry take on new and connected meaning.

The greatest research needs are to understand how roles and responsibilities change in the digital environment. The nature of library work and the function of libraries will change dramatically. In the digital world, libraries and librarians do not—cannot—work in isolation. The nature of digital information is such that both its creators and publishers along with technologists must join librarians in organizing its preservation. When librarians provide access to publishers' electronic products, they typically do not own those products or the intellectual property rights in them. Preservation for long-term access, a traditional responsibility of research libraries, must now be achieved through collaboration among heretofore unlikely partners.

User studies become increasingly important as libraries move from housing materials to providing electronic access to them, becoming gateways to material instead of owners. To succeed in this new business, libraries must understand how users look for and find the information they need. And if access provision becomes the primary role, libraries must determine how they can add value to the information retrieval process.

The confluence of these issues will force us to think in new ways about the requirements for those who will serve in information roles. Research will also be needed to inform approaches to recruiting, educating, and providing ongoing training to those who will be responsible for the library of the future.

## NOTES

1. See Rush Miller and Sherrie Schmidt, "E-Metrics: Measures for Electronic Resources," a keynote paper delivered at the 4th Northumbria International Conference on Performance Measurement in Libraries and Information Services, at http://www.arl.org/stats/newmeas/emetrics/miller-schmidt.pdf.
2. For information on the Oberlin Group, see http://dewey.willamette.edu/publications/movtyp/spring99/english.html. The statistics collected by the group from its members are not generally available to others.
3. These points are elucidated by Deanna B. Marcum and Anne Kenney in "The Preservation of Our Brittle Books Must Also Preserve Access," *The Chronicle Review,* March 8, 2002, p. B-20.

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# The Invisible Library: Paradox of the Global Information Infrastructure

CHRISTINE L. BORGMAN

## ABSTRACT

LIBRARIES ARE AN ESSENTIAL COMPONENT of a nation's information infrastructure, yet often they are invisible to their users and other stakeholders. In the context of this special issue, the paper presents four challenges faced by libraries and proposes research designs to address each of them. The four challenges involve: 1. invisible infrastructure, 2. content and collections, 3. preservation and access, and 4. institutional boundaries. I propose a mixture of research methods that includes surveys, case studies, documentary analyses, and policy analyses. Only with a better understanding of these challenges can libraries find their best fit in the information infrastructure of our networked world.

## INTRODUCTION

Computer and communication networks now encircle the globe. Despite the oft-repeated claim that half the world's population has never made a telephone call, we receive daily television, radio, and newspaper reports filed via satellite from Afghanistan, one of the planet's least-developed countries. Many of these reports become available almost immediately on the Internet. Information technologies have become ubiquitous in the developed world and widely available elsewhere.

An increasing proportion of communication and commerce takes place via computer networks. Friends, family, colleagues, and strangers rely on e-mail to maintain relationships and to transact business. Most of the activities of writing, editing, and publishing involve computers and networks regardless of whether the final product appears online or on paper, mak-

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 652–674

ing "electronic publishing" a misnomer. Even in the "old economy," orders are placed, invoices are paid, and credit cards are verified and charged via computer networks. Individuals turn to the Internet as a primary source for all sorts of information—health, hobbies, homework, news, shopping, music, games, research, and general curiosity.

Libraries are but one of many institutions that could no longer function without computer networks, at least in the developed world. Libraries depend upon computer networks as a means to provide access to local and remote information resources. While physical materials continue to form the core of most library collections, fewer and fewer services require that users physically enter the library building. Even artifacts such as books can be ordered online for delivery to one's home or office.

A paradox of the networked world is that as libraries become more embedded in the information infrastructure of universities, communities, governments, corporations, and other entities, the less visible they may become to their users, funders, and policy-makers. Libraries must be integral components of the information infrastructure of their organizations if they are to provide the most effective, efficient, and appropriate services to their user communities. Independence and isolation are not suitable alternatives.

Historically, libraries have played key roles in information-oriented societies. Yet today, some of their roles are being duplicated by other public institutions such as archives and museums and by commercial providers of content and services. Individuals and organizations now have many information sources alternative to those provided by libraries, which would suggest that the role of libraries is shrinking. However, libraries are expanding to include a wider array of services, such as providing digital libraries and support for distance learning. Despite this broader scope, libraries exist in a competitive environment, facing greater demands for services and often with fewer resources to meet those demands.

Libraries can and should play key roles in the emerging global information infrastructure. To do so, they must address a number of complex challenges. Research on these challenges will assist libraries in identifying and accomplishing their roles in a global information infrastructure. The four challenges for libraries are introduced in a recent book (Borgman, 2000). Here I extend and update those issues, frame them as research questions, and suggest methods to explore them.

## Information Infrastructure

A first step in exploring the role of libraries in a global information infrastructure is to consider what is meant by "infrastructure." Familiar phrases such as "national information infrastructure" and "global information infrastructure" are rarely accompanied by clear definitions of the underlying concepts. Star and Ruhleder (1996) were among the first to de-

scribe infrastructure as a social and technical construct. Their eight dimensions can be paraphrased as follows: An infrastructure is *embedded* in other structures, social arrangements, and technologies. It is *transparent,* in that it invisibly supports tasks. Its *reach or scope* may be spatial or temporal, in that it reaches beyond a single event or a single site of practice. Infrastructure is *learned as part of membership* of an organization or group. It is linked with *conventions of practice* of day-to-day work. Infrastructure is the *embodiment of standards,* so that other tools and infrastructures can interconnect in a standardized way. It builds upon an *installed base,* inheriting both strengths and limitations from that base. And infrastructure becomes *visible upon breakdown,* in that we are most aware of it when it fails to work—when the server is down, the electrical power grid fails, or the highway bridge collapses.

Integrated library systems (i.e., automated systems that support core processing functions such as acquisitions, serials, cataloging, and circulation) offer a familiar example of an infrastructure within an organization. Following Star and Ruhleder's (1996) model, we see that integrated library systems are embedded in the work practices of libraries and depend upon certain jobs and relationships in addition to specific technologies. They support the processing of materials and resources at multiple sites and enable remote access to cataloging and other databases twenty-four hours a day. Upon joining the community, both staff and patrons learn to use the systems and to develop certain expectations of services. Integrated library systems embody national and international standards, both library-specific (e.g., MARC, Z39.50) and general technical standards (e.g., Unicode, TCP/IP). These systems build upon an installed base—usually consisting of cataloging records, holdings records, and other records in standard formats—and established practices. When the system breaks down—for example, when library catalogs cannot be searched, or when books cannot be renewed—then the infrastructure becomes very visible.

*Information infrastructure* is only one type of infrastructure, but one that has at least three definitions. Firstly, the term "information infrastructure" is often used as a public policy construct to include technical capabilities of the network, rights and guarantees of network services, and means for funding development and for regulating the network. Some examples are the (U.S.) National Information Infrastructure Act of 1993 (National Information Infrastructure: Agenda for Action, 1993), the European Union proposal for a unified European Information Infrastructure (Europe and the Global Information Society, 1994), and the Group of Seven (G-7) Ministerial Conference on the Information Society (1995). This last document established a framework for a global information infrastructure.

A second sense of the term "information infrastructure" is as a technical framework that incorporates the Internet and its services (National Research Council, 1994). The Internet is a network of networks, linking many layers of networks within organizations, within local geographic ar-

eas, within countries, and within larger geographical regions. The third sense of the term "information infrastructure" is as a general framework that encompasses a nation's networks, computers, software, information resources, developers, and producers (National Information Infrastructure: Agenda for Action 1993). In this article, the term "information infrastructure" is used in this last sense of an encompassing framework.

## The Role of Libraries in Information Infrastructure

Libraries are inherently information institutions. They are part of a nation's information infrastructure in the third sense of the term (above). Libraries rely heavily on computers and computer networks, at least in developed countries. They select, collect, organize, preserve, conserve, and provide access to information resources. They provide an array of information services, and may also develop and produce content. Although these characteristics suggest that libraries would be considered central to the development of information infrastructure in most countries, few policy documents about information infrastructure mention the role of institutions such as libraries, museums, or archives in providing content or services. Clearly, it is up to the library community to identify and articulate its goals in information infrastructure and to act upon them.

This article addresses several of the challenges facing libraries in determining their present and future roles in their nation's information infrastructure and in a global information infrastructure. These challenges involve the following issues:

1. Invisible infrastructure
2. Content and collections
3. Preservation and access
4. Institutional boundaries

These four topics were first proposed in Borgman (2000, chapter 7). Here I extend the scope of each topic, identify associated research questions, and suggest methods by which the questions could be addressed. The conceptualization and literature reviews are by no means exhaustive. Each of the four challenge topics is deserving of article-length, if not book-length, treatment. For ease of explanation, the research designs are described as individual studies at individual institutions. In practice, research should be replicated at many institutions. Better yet, research to address these challenges should be coordinated to provide broad insights on a regional, national, and international basis.

For this special issue we were asked to identify research questions that are important for the field to address in the next five to ten years. Predicting the future is always risky. Issues and trends are hard to spot, and even if on target, the timing is unlikely to be accurate. The best one can do is to offer "the view from here." Thus, implicit in these research designs is

the admonition to reassess the relevance of these questions, and to do so continuously. As scholars and practitioners, we should endeavor to scan the environment and to be aware of issues at least one day sooner than our stakeholders.

*Challenge 1: Invisible Infrastructure*

Despite the expanding scope of library services, more people seem to claim that they never go to the library anymore because everything they need is online. Even more disturbing are statements by managers who expect to build new campuses or new offices with minimal library collections, because they see a diminishing role for libraries. Why are libraries so invisible?

The invisibility is partly due to the successes of the institution. Good library design means that people can find what they need, when they need it, in a form they want. Good design is less obvious than bad design, and thus libraries risk being victims of their own success. Another component is the invisible content and costs of libraries. Many users are simply unaware of the expense of acquiring and managing information resources or the amount of value added by libraries and librarians. Considerable professional time and vast amounts of paraprofessional and clerical time are devoted to the processes of selecting, collecting, organizing, preserving, and conserving materials so that they are available for access. The selection process requires a continuing dialog with the user community to determine current needs, continuous scanning of available information resources, and judicious application of financial resources. Once selected, the items are collected, whether physically or by acquiring access rights. This process, which requires negotiation with publishers and others who hold the rights to desired items, sometimes takes months or years, depending on the resources and the rights. As new items are acquired, metadata are created to describe their form, content, and relationship to other items in the collection. Once in the collection, resources must be preserved and conserved to ensure continuous availability over time. The invisibility of information work was identified long ago (Paisley, 1980), but the implications of this invisibility are only now becoming widely apparent.

Library and information services should be tightly coupled with other aspects of the information infrastructure of an organization (university, school, city government, corporation, etc.). But how do libraries provide a seamless infrastructure while maintaining visibility? How do they continuously respond to the evolution of their communities, or better yet, anticipate the evolution of the community's infrastructure as a means to provide the best resources and services? Libraries have a variety of stakeholders, including their users, their parent organizations (which are usually their primary funding source), other funding sources (foundations, donors, paying customers), and employees. Some stakeholders of libraries are par-

ticularly difficult to identify or characterize, such as the future users of their collections, many of whom have not yet been born.

*Research Questions.* The Invisible Infrastructure issues are summarized in the following questions:

- How visible are libraries to their stakeholders?
- How are the goals of stakeholders reflected in the library's goals?
- What are the consequences of visibility or lack of it?
- How can libraries be more visible to their stakeholders?

*Research Design.* This is a complementary set of research questions. We want to know how aware users are of the library and how embedded library services are in their practices. Similarly, it would be useful to know how aware other library stakeholders are of library services, and their expectations of those services. On the other hand, we also wish to know how aware the library is of user and stakeholder needs, plans, and strategic directions, and how well these goals are reflected in the library's plans.

The design presented here is tailored to university libraries, because many universities are currently developing their information infrastructures. However, most aspects of the design are stated in terms that could be adapted to other settings such as national, public, school, and special libraries. Some additional questions for public libraries are given at the end of this section.

Studies to address these research questions could be exploratory or descriptive in nature. Not enough is yet known about the problem to conduct an explanatory study such as an experiment (Babbie, 2001). Surveys and case studies are good starting points to address the challenge of libraries' visibility. Qualitative studies of users in their own environments also will be fruitful (Lofland & Lofland, 1995).

*Sample.* We could interview a representative sample of students, faculty, and staff of the university. Staff would have a range of perspectives, varying from administrative assistants to vice presidents (or vice chancellors or vice provosts, depending upon the organizational structure). Students' perspectives are likely to vary by disciplinary interests and degree objectives. Thus, stratified samples would be appropriate. Some questions will be adapted to different strata, such as asking questions of faculty about teaching and research, and of students about coursework and noncoursework needs.

Case studies of small groups or individuals could be fruitful. The sample could include a department in each of physical sciences, life sciences, technology, social sciences, humanities, and professional schools. Faculty from each group could be interviewed in their offices, looking closely at their information-related practices.

*Selected Topics and Questions. Services:* When do you use library services? Please describe the most recent time you used any library services. What

prompted you to use them? What other types of information resources did you use? In what order did you use them? (Add probes to determine whether the library is used as "one-stop shopping," is the first stop, the stop of last resort, etc.) What services or sources of information in the library are most valuable to you? Least valuable? What do you most use that the library does not provide? What else should the library provide?

*Infrastructure:* Where does the library fit in the university? What do you think is the most important service it can provide or role it can play? If the library budget were to be cut by 20 percent, where would *you* make the cuts? If the budget were increased by 20 percent, what would you add? What role should the library play in teaching? In research? In supporting administrative activities?

*Strategic planning:* Data about the university's process of strategic planning for information infrastructure should be gathered and analyzed. Where does the library fit? How will resources be delivered to offices, classrooms, and off-site for distance-independent learning? What are the priorities for the university? Who is involved in strategic planning?

*Additional questions for public libraries:* What kind of strategic planning is the city, county, state, or other parent government doing for information technology and where do library services fit? What role does the community see for the library?

*Challenge 2: Content and Collections*

Until very recently, libraries were judged by their collections rather than by their services. Scholars sought out, and traveled to, the great collections of the world. The collections of major libraries are much more than the sum of their parts; disparate items are brought together, and relationships between items are identified. But what does it mean "to collect" in today's environment, when libraries provide access to content for which no physical artifact is acquired? The question is further complicated by the fact that access may be temporary for the term of a contract, rather than (relatively) permanent, as for purchased materials.

To explore the definition of "collection" in the networked information infrastructure, it is useful to return to Buckland's (1992) typology of the purposes for collections. These are 1. preservation (keeping materials for the future, as they may be unavailable if not collected at the time of their creation); 2. dispensing (providing access to their contents); 3. bibliographic (identifying what exists on a topic); and 4. symbolic (conferring status and prestige on the institution). The mapping of Buckland's typology to digital collections is not immediately obvious, and gives rise to several research questions in this area.

In recent years, much of the discussion of digital collections has come under the rubric of digital libraries (Lynch, 1999). "Digital libraries" is itself a contested term, as discussed in depth elsewhere (Borgman, 1999,

2000). In this article, the two-part definition established in Borgman et al. (1996) is assumed:

> Digital libraries are a set of electronic resources and associated technical capabilities for creating, searching, and using information. In this sense they are an extension and enhancement of information storage and retrieval systems that manipulate digital data in any medium (text, images, sounds; static or dynamic images) and exist in distributed networks. The content of digital libraries includes data, metadata that describe various aspects of the data (e.g., representation, creator, owner, reproduction rights), and metadata that consist of links or relationships to other data or metadata, whether internal or external to the digital library.

Digital libraries are constructed—collected and organized—by [and for] a community of users, and their functional capabilities support the information needs and uses of that community. They are a component of communities in which individuals and groups interact with each other, using data, information, and knowledge resources and systems. In this sense they are an extension, enhancement, and integration of a variety of information institutions as physical places where resources are selected, collected, organized, preserved, and accessed in support of a user community. These information institutions include, among others, libraries, museums, archives, and schools, but digital libraries also extend and serve other community settings, including classrooms, offices, laboratories, homes, and public spaces.

Implicit in this definition of digital libraries is a broad conceptualization of library "collections." One theme is that digital libraries encompass the full information life cycle: capturing information at the time of creation, making it accessible, maintaining and preserving it in forms useful to the user community, and sometimes disposing of information. With physical collections, users discover and retrieve content of interest; their use of that material is independent of library systems and services. With digital collections, users may retrieve, manipulate, and contribute content. Thus users are dependent upon the functions and services provided by digital libraries; work practices may become more tightly coupled to system capabilities.

A second theme implicit in the definition of digital libraries is the expanding scope of content that is available. Content now readily available in digital form includes primary sources such as remote sensing data, census data, and archival documents. Use of scientific data sets is computationally intensive, raising questions about the role the library should play in providing access to the resources and to the tools to use them (Lynch, 1999). Nor are scientific data the only challenge. As more archives and special collections are digitized, many primary sources in the humanities are becoming more widely available online than are secondary sources such as books and journals. Distinctions between "primary and secondary sources"

are problematic, however, as they vary considerably by discipline and by context. Some sources may be primary for some purposes and secondary for others. Here I oversimplify the terms by referring to raw data and to unique or original documents as primary sources and to analyzed or compiled data and to reports of research as secondary sources.

A third theme is the need to maintain coherence of library collections (Lynch 1999). Descriptions (and sometimes content) of journal articles, for example, can be found in catalogs, indexing and abstracting databases, and digital libraries. Users want to identify articles of interest and to move seamlessly from bibliographic references to the full text, and from references in those texts directly to the full content of the cited articles. Sometimes they also wish to link directly to primary sources on which the articles are based. Supporting these uses of journal-related information requires various forms of links within and between many independent catalogs, databases, and digital libraries.

Efforts at improving the coherence of collections include the CrossRef initiative (http://www.crossref.org) developed by a consortium of major scholarly publishers to link citations using Digital Object Identifiers (http://www.doi.org), and the Open Archives Initiative (OAI). CrossRef allows users to follow citations across the boundaries of individual publishers, while the OAI enables libraries to make their digital collections more widely available in a standard form (Lagoze & Van de Sompel, 2001; http://www.openarchives.org). Coherence always has been a problem in the print world, however. Catalogs of a library's collections typically contain entries only for about 2 percent of the individual items a user might seek, based on Tyckoson's clever assessment of some years back (Tyckoson, 1989). For the rest, library users are dependent upon indexing and abstracting databases, finding aids, various locally developed tools and arrangements (such as shelves for new books, or shelves organized by genre, as are common in public libraries), and the knowledge of librarians. However, even the concept of catalogs is changing as libraries merge records on their own holdings with records from indexing and abstracting databases and with records for online resources external to the collection. The use of Web-based portals or gateways is another step toward coherence. A portal can bring together in one place the many types of resources and finding aids offered by the library—a goal that was difficult to accomplish in the print environment.

The Content and Collections challenge outlined here is a subset of a larger set of concerns about how to evaluate digital libraries. Research, planning, and deployment of digital libraries all can benefit from evaluation—whether formative, summative, iterative, or comparative. Evaluation efforts can have substantial benefits to digital library development by focusing designers on measurable goals, by providing data on which to reassess those goals, and by assessing outcomes. An array of methods and measure-

ment issues was identified in a recent workshop on digital library evaluation that was jointly sponsored by the National Science Foundation and the European Union (Borgman, 2002).

*Research Questions.* The goal is to determine the nature of collections and their role in the information infrastructure of parent organizations (universities, governments, corporations, etc.), nations, and the world. We can address the Content and Collections challenge via the following research questions:

- What are "collections"?
- How are collections used?
- How can communities and collections best be matched?
- How can the coherence of collections be established and maintained?

*Research Design.* Multiple methods will be required to approach this array of research questions. One approach is to conduct interviews, surveys, and case studies of users and librarians to determine their views on these questions and to study actual uses of collections. A particularly effective approach is to interview faculty in their offices, looking closely at their information-related practices. This is one of a number of approaches we are taking in the ADEPT project,[1] which is studying the use of digital libraries for teaching undergraduate courses in geography (Borgman, et al., 2000).

A complementary approach is to document the nature of extant collections (physical and digital), the metadata that exists for them, and the functions and services available to support them.

*Sample.* For the behavioral and policy questions, we could interview a representative sample of students, faculty, and staff of one or more universities, as proposed for the first challenge. A similar stratified sample that reflects disciplinary interests and degree objectives would be appropriate. However, smaller samples for more in-depth interviews would be needed for this set of studies. Some questions are best addressed to library staff, although in many cases it would be beneficial to address similar questions about collections to librarians and to users.

Case studies of small groups or individuals may be especially fruitful, as behavioral studies of information use tend to be detailed and labor-intensive to conduct. Content, collections, uses, and users vary considerably by discipline, so multiple studies with different samples would be required.

Collection studies could be approached in several ways. Samples could be drawn from the obvious collections, such as books, journals, and online databases to which the library subscribes. The surveys and interviews should yield some definitions of what a library's users view as collections. These are likely to include locally developed resources outside the purview of the library (e.g., survey data, scientific data, collections of models assembled for research projects). Any or all of these collections could be sampled for study, with the goal of determining how well the data, metadata,

functionality, and services match the expressed needs of the user communities they are intended to serve.

*Selected Topics and Questions.* Buckland's (1992) typology of collection purposes generates some framing questions for both the behavioral and documentary approaches to researching this challenge: When a library acquires access to remote digital libraries on behalf of its user community, is that digital library part of "the collection"? Who is responsible for preserving digital content in distributed environments? What are the boundaries of a library's collection when it dispenses resources that it does not physically house and may not own? When libraries rely on cooperatively maintained digital libraries of metadata to determine what exists, where it exists, and how to acquire access to it, who is responsible for bibliographic control? Does having a large collection of electronic resources confer the same status on an institution as having a large collection of printed materials?

Research that asks the respondents to define basic concepts is particularly difficult, for it risks leading the respondent to a desired outcome. An approach that Caidi (2001) found effective in getting respondents to define "information infrastructure" was to offer them a list of distinct definitions (she used four different definitions of "infrastructure") and to ask them to explain which of them best reflects their own understanding of the concept. The respondents were able to expand upon one or more of the definitions to arrive at their own conception. A similar approach might be particularly effective in eliciting definitions of "collection" from information seekers and from library staff.

Several questions should address the "information life cycle": What do people do with information resources once they have them? How do they use them? Do they write new documents (articles, books, music, art, performances, etc.)? Do they publish online and/or offline? Do they use the resources to read, research, prepare for exams, get a job, invest, or make health decisions?

Multiple groups should be asked about their definitions of collections, the value of collections, criteria for selection, and how they use collections. Some additional questions can be tailored to individual groups, such as the following:

*Faculty:* Ask questions about the use of collections for teaching and research. How do they collect and organize resources for their courses? Where do they get new materials? How do they make them available to students (e.g., as texts, course readers, library reserves, electronic reserves, Web sites)? Who assists them in collecting and organizing resources now? Who should do so in the future? What balance of primary and secondary sources do they use? How does their use of collections vary between teaching and research?[2]

Faculty should also be asked about their engagement in research projects to construct collections of digital resources for their fields. Increas-

ingly, research groups are assembling portals that aggregate a range of resources for a research problem. Digital library projects within individual disciplines of the sciences, social sciences, and humanities are producing a wealth of new and innovative resources for teaching and research (http://www.dli2.nsf.gov). However, these projects tend to address technical aspects of constructing digital libraries, rather than their use for teaching and research. Much more needs to be known about the uses and users of such collections.

*Students:* Ask questions to determine the collections they use and for what purposes. When do they go to Google and other Internet search engines? When do they use library or other university sources? How does online availability enhance or constrain their information seeking? How much of their collection use is for course-related vs. non–course related purposes?

*Library staff:* Librarians and other library staff may make fine-grained distinctions between types of collections and uses of them, given their professional education and experience. How do they define collections? What are their criteria for selection, preservation, authority, authenticity, etc.?

*Challenge 3: Preservation and Access*

While little agreement may exist on the definition of a library "collection," most librarians would agree that the collections must be preserved so that they remain accessible. Portions of physical collections are crumbling, and libraries are undertaking cooperative efforts to preserve the content, physical artifacts, or both. Preservation of digital collections is yet more complex and potentially even more expensive than preserving printed resources. Most printed volumes will survive via "benign neglect," provided they are shelved under adequate climate controls. Digital resources must be continually migrated to new software and new technologies, thus active management is required for preservation (Smith, 1999). When a library owns the rights to the digital content, the library presumably is responsible for maintaining continual access, absent other cooperative agreements. When a library is leasing access to digital content, responsibility for preservation may be diffuse. Authors are unlikely to take responsibility and, even if they might wish to do so, may not have the legal authority if they have assigned copyright to the publisher. Publishers wish to maintain control, but few are willing to assure long-term continuous access. Even if they were willing, the rate of acquisitions and mergers in the publishing industry suggests that long-term commitments may be difficult to enforce. Recently, publishers have expressed more interest in allowing libraries to maintain digital content, but the economic model under which libraries might accept such responsibility is not clear (National Research Council, 2000; Yakel, 2001). Third parties such as OCLC are now stepping to the fore as repositories, which is a promising model (http://www.oclc.org).

"Access" is a term that is widely used in our field but rarely defined. It incorporates aspects of freedom, ability, connectivity, usability, and rights. Elsewhere (Borgman, 2000, p. 57), I defined "access to information" as "connectivity to a computer network and to available content, such that the technology is usable, the user has the requisite skills and knowledge, and the content itself is in a usable and useful form."

In my initial framing of the challenge of preservation and access (Borgman, 2000, chapter 7), I focused primarily on the library's role in preserving digital resources. Preservation and access are critical public policy concerns in which libraries should have a voice, as social institutions with substantial responsibility for maintaining access to their institutions' and nations' informational and cultural heritage. Deanna B. Marcum (in this issue of *Library Trends*) ably addresses the challenges faced by libraries in this arena. Thus, I turn my attention to the challenge of long-term access to online content and the concerns for persistence of content in national and international information infrastructures.

Online resources are most commonly identified by URLs (Uniform Resource Locators), (Berners-Lee, Masinter, & McCahill, 1994). URLs identify a location, rather than a document, and thus are far less stable than bibliographic references. Persistence issues associated with URLs are best explained by example. My home page currently resides at this URL: http://is.gseis.ucla.edu/cborgman/. This is the fourth URL for my home page in the last five years. The URL has varied due to changes in the department name ("dlis" to "is") and to variations in local conventions such as the use of computer names in URLs (e.g., "skipper") and internal hierarchy (e.g., "/faculty/~cborgman"). The content of my home page is updated periodically, with new entries added and new documents posted. The links to those documents sometimes change, due to location changes or to changes in the status of the document (e.g., from draft to published). Documents are sometimes superseded by more current versions with different names and locations. The software in which the documents are written and posted includes various versions of Corel WordPerfect, Microsoft Word, and PDF. This simple and common example typifies the array of persistence problems related to the use of URLs:

- *Location changes:* the home page is at a new URL; documents linked from the homepage move to different URLs.
- *Content changes:* the home page address is the same but the content has changed; documents are updated without changing name or location.
- *Format changes:* the document is migrated to a new software format; the intellectual content may be the same, but the documents are no longer "bit for bit" identical.
- *Status changes:* the document content is no longer current; it may have been superseded by another document at another location, and may or may not be linked to the subsequent document.

The lack of persistence of URLs becomes increasingly problematic as people rely more heavily on online documents. Yet, we know little about how individuals and organizations cope with these problems. What are users' expectations for stable access to online documents? They probably expect home pages to be updated, but they probably also expect to find the same individual document at the same URL the next time they visit. Some of these problems are being addressed by new forms of identifiers such as URIs and URNs (Berners-Lee et al., 1994; Berners-Lee et al., 1998), but none claims to be a universal solution, nor are they widely implemented. The proposed OpenURL standard (Van de Sompel & Beit-Arie, 2001; http://library.caltech.edu/openurl/) provides context-sensitive linking and supports the CrossRef/DOI (digital object identifier) initiative of major publishers. As of this writing, the OpenURL approach is being implemented in commercial software for library applications and appears promising for some aspects of the URL persistence problem.

Bibliographic references are far more stable than URLs, but still have some of these persistence issues. Catalogers control variations by establishing relationships between items, works, and manifestations, and by establishing cross references between related works or editions (Leazer, 1994; Svenonius, 2000; Tillett, 1991, 1992). The cataloging approach may work within a closed network of cooperating libraries, but Webmasters and writers and publishers of online documents are not bound by cataloging practices or other sets of consistent rules. The costs of creating cataloging records usually are deemed justified for printed documents that libraries will hold indefinitely. However, the cost of creating cataloging or metadata records for every electronic document may be prohibitive. The information science research community is revisiting the age-old question of when to invest in description at the time of record creation and when to invest in improved retrieval techniques for use at the time that information is sought (Liddy, et al., 2002). Automatic indexing may prove sufficient for retrieval by elements that exist in the record, but extrinsic metadata, such as intellectual property rights and the provenance of electronic records, also may be needed. All of these metadata choices will influence the persistence of electronic documents.

*Research Questions.* Preservation and access of online documents is a challenge being tackled aggressively by technical and policy organizations such as the Internet Engineering Task Force (http://www.ietf.org), and the World Wide Web Consortium (http://www.w3c.org), and by the library and information science community (Marcum, this issue; Yakel, 2001). The LIS community can contribute productively to these discussions by addressing the following research questions:

- To what degree does the lack of stability of online documents, and links to online documents, influence preservation of, and access to, library resources?

- To what degree are users, seekers, and producers of digital resources aware of online persistence issues?
- How do users, seekers, and producers of digital resources address persistence problems?
- How might library methods for organization of knowledge be employed to improve the stability of access to online resources? How might other organization of knowledge practices be employed, such as those from the archival and museum communities? What are the implications for persistence when little, if any, metadata are associated with documents?

*Research Design.* Studies to address these questions will require a combination of analyzing the use of library resources (research question #1); interviewing users, seekers, and producers of Internet resources about their activities and practices (questions #2 and #3); and theoretical and empirical studies of knowledge organization principles (question #4).

The first research question could be addressed by studies of a library's collections to identify the distribution of digital resources that are under the library's control (e.g., locally managed digital libraries), that are partially under the library's control (e.g., in commercial databases for which access is leased), and those over which the library has minimal control (e.g., on the World Wide Web or other Internet source). The studies should assess how much each of the resources depends upon URLs, URIs, or other identifiers such as Digital Object Identifiers, ISBN, ISSN, etc.

Research question #4 could follow the models of prior research on document relationships conducted by Gilliland-Swetland (2000), Leazer (1994), Svenonius (2000), and Tillett (1991, 1992). Research questions #2 and #3 require user studies similar to those outlined in the first two challenges.

*Sample.* The most comprehensive approach to addressing the persistence problem in preservation and access would be to study all four questions within one institution. In that way, the array of available resources could be compared with the practices of those who use them, and with the organizational methods applied. Alternative approaches are to address each of the four research questions across multiple institutions, or to address each question individually. Research question #4 is most easily separated from the other three, as libraries apply reasonably consistent knowledge organization practices—at least within a given country. Multinational comparisons of organizational practices also would be valuable.

Samples for the surveys and case studies (research questions #2 and #3) could be drawn in the same way as in the first two challenges. However, it may also be necessary to study the practices of Webmasters (inside and outside the institution), and writers and publishers of online resources who are outside the institution but whose resources are used by people within the institution under study.

*Selected Topics and Questions. Preservation and access of library resources:* Conduct a "collection analysis" of digital resources to which the library provides access. How is persistence maintained in each of these resources? What identifiers are employed? What are the principles underlying each type of identifier? How stable are the identifiers? What data are available on the persistence of identifiers? These data might be provided by purveyors of digital libraries, by search engines, by the Internet Archive (also known as the *Wayback Machine*) (http://www.archive.org/) from other studies, and by collecting transaction data from university servers.

*User awareness of online persistence problems and user coping mechanisms:* Ask users and seekers of digital resources about their experiences in locating information online. How often do they encounter incorrect addresses for resources? How often do they encounter links to new addresses where documents were moved? When they find incorrect addresses, what do they do? Do they search for the resources using other tools? Do they try to find the original source or pointer to the site? How do they identify sites of interest? To what extent do they rely on bookmarks, search for known sites, or rely on links provided by others? Do they download or otherwise capture content of interest to preserve it locally, in anticipation of dead links? Do they attempt to verify if the content is the same as was sought? If so, what are their methods and criteria? How do they use the links once found? Do they maintain a record of dates visited, for example?

Similar sets of questions can be asked of those who maintain Web sites and write for online publication. What are their practices for assuring persistence of their content? What are their criteria for updating existing documents, for creating new documents, and for indicating when and what type of changes have been made to a document? What address mechanisms do they employ? How often do documents change address, and under what circumstances? The answers to these questions are likely to vary widely by genre, so multiple studies should be conducted. Web sites maintained by libraries, archives, and museums are likely to have more sophisticated practices than sites for Weblogs ("blogs"), political protests, or fan clubs, for example. A useful approach would be to determine the distribution of sites visited by the user community and then to segment the study of sites accordingly.

*Organizational methods to address persistence problems:* These studies will be informed by results from the prior studies on the distribution of digital resources, on how online resources are used, on the types of problems encountered, and on users' approaches to dealing with these problems. Models for improving Web organization, such as "the semantic Web" (http://www.w3c.org), should be analyzed from a persistence perspective. The various representation models employed by libraries, archives, and museums should be examined for lessons about persistence that can be applied to organization of online sources. While global solutions would require

coordinated, long-term approaches, libraries and other institutions can seek methods to improve the persistence of their own resources now.

*Challenge 4: Institutional Boundaries*

My original framing of issues associated with institutional boundaries focused on relationships between libraries, archives, and museums (Borgman, 2000). These three information institutions face similar concerns, such as the risk of becoming an invisible part of the infrastructure, the changing nature of collections, and preservation and access for content and artifacts. The distinction between these information institutions was not well established until the late twentieth century (Rayward, 1993). Until then, books, papers, works of art, specimens of plants and animals, fossils, minerals, coins, and other objects were gathered in common collections. These collections supported broad, multidisciplinary intellectual interests, without the division between the sciences and the humanities that we take for granted today.

Much of the distinction between these institutions is based on the type of material collected. Libraries mostly collect published materials. Archives mostly collect the records of individuals, organizations, and governments. Museums collect almost anything, organizing it around a general theme (such as art, history, or natural history), a specific theme (such as air and space or automobiles), or a highly specialized theme such as the history of a particular automobile. These distinctions by type of material become less useful as more content exists in a common form, namely digital. Furthermore, partitioning intellectual content among these three sets of institutions is an artificial division of the natural world that does not necessarily serve the information seeker well.

In a world of physical materials, access was determined by physical space: users had to decide which building to enter. Access mechanisms (catalogs, finding aids, museum directories) were located inside the buildings. Now the access mechanisms for many collections are available online; users can browse the holdings of libraries, archives, and museums, and even "visit" virtual museum collections. Search engines such as Google (http://www.google.com), AltaVista (http://www.altavista.com), Alexa Internet (http://www.alexa.com), and one of the newest, Teoma (http://www.teoma.com) do not distinguish between these institutions or between institutions and individuals, for that matter. Topical searches in these engines produce matches from across the spectrum of public and private, commercial and nonprofit, scholarly and personal opinion, published and unpublished, and formal and informal sources.

Paradoxically, the holdings of information institutions are often the least visible to Internet search engines. This is known as the "dark Web" problem (Lynch, 2001). Search engines generally can capture content only on static Web pages. The contents of library catalogs are stored in data-

bases. Web pages of search results are generated dynamically for each query; they do not exist in a static form that search engines can capture. Thus, a Google search on "Shakespeare" may retrieve sites that specialize in Shakespearean memorabilia (as described in their Web pages), sites of theaters that are currently performing Shakespearean plays, and Shakespeare fan clubs, but usually will not retrieve catalog records for books in libraries or for records in archives. Harvesting models, such as the Open Archives Initiative (Lagoze & Van de Sompel, 2001) will solve part of the dark Web problem. The dark Web encompasses not only the catalogs, finding aids, and directories of information institutions, but also the vast intranets that are hidden behind firewalls of many corporations, governments, and other organizations. The Internet consists of a mix of public and private sites, and search engines actually index only a small proportion of all extant Web pages.

While the broad retrieval by search engines such as Google offers many new opportunities for information seekers (and is extremely popular), in some respects it represents a step backwards from traditional approaches to knowledge organization. One of the most fundamental problems with Internet navigation is the lack of context for the search (Furner, 2002; Solomon, 2002). The Internet is being used to find sites, sources, services, documents, people, and activities that would be located by diverse offline mechanisms, if at all—library catalogs, phone directories, museums, archives, travel agents, government agencies, encyclopedias, directories of persons, etc. In most other information retrieval situations, context is provided by segmenting the database being searched or by constraining the meaning of terms within the database.

Although the context for a search may be obvious to the user, search engines can operate only with the terms they receive. A user who is planning a European trip may type "Paris" into a search engine. He or she probably expects to retrieve tourist information on the city of Paris, France, but how does a search engine know that? A student studying the *Iliad* more likely wants to know about the Greek hero after which the city of Paris was named. In other contexts, someone who enters "Paris" as a search term may be seeking a source for plaster of Paris, movies that contain the word "Paris" in the title, people with the first or family name of Paris, or historical, economic, or political perspectives on the city.

Thus, the challenge of institutional boundaries has several components. One component is the fuzzy lines between types of information institutions. A second is the fading of boundaries between institutional sources for discovering information resources. Searchers may make little distinction between searching the resources of libraries, archives, museums, corporate, or other organizations. Third is the difficulty of establishing context for searching. Coherence of collections, as discussed in the second challenge,

is difficult when framed in terms of the resources offered by an individual library. How does a library provide a "coherent user experience" to a community that has access to a vast array of resources beyond the library?

*Research Questions.* The blurring of boundaries between information institutions and between information institutions and other sources of collections and services raises new questions about the visibility and role of libraries. Many of these are policy questions, and all will be informed by the results of studies on the prior three challenges presented.

- What are the roles of information institutions in providing access to information?
- Where do institutions add value to information resources and services?
- What forms of cooperation and alliances between institutions are most beneficial, and for what purposes?
- How is context best provided in information seeking and use?

*Research Design.* The first three of these research questions are addressed most directly by policy research, and the fourth question also has policy components. Studies in response to the earlier challenges may provide baseline data and may identify some of the criteria for assessing roles and value. We can conduct documentary studies of the role of libraries and other information institutions in various local, regional, national, international, and cultural contexts. We can interview stakeholders with policy responsibilities, such as senior managers in government funding agencies, in universities, and in corporations. The third question can be addressed by studying the history of cooperation within and between these institutions, and by looking more broadly at other types of cooperation models. The fourth question is a mix of policy, technology, and behavioral studies. Context might be provided via institutional, technical, or business models.

*Sample.* As noted in the research design, we would examine various literature and policy documents about the roles of these institutions, and would interview a wide variety of stakeholders. Libraries, museums, and archives that have overlapping user communities should be studied together to address some of these questions.

*Selected Topics and Questions. Policy questions:* We tend to assume that libraries, museums, and archives serve overlapping communities. But what degree of overlap does exist, and in what areas? What roles do the stakeholders of each institution think are most important? What priorities do they ascribe to these roles? Many of the functions provided by these institutions require large amounts of invisible work, such as selecting, collecting, organizing, preserving, and conserving resources so that they are accessible. What priorities should be set for the invisible work of libraries? Who should do this work? Which parts are essential? Which parts are expendable? Which could be accomplished by more cost-effective means? Which require greater investments? Which functions could be disaggregated and

divided between institutions and which are most effective when aggregated (Fuller, 2002)?

*Context:* Some of these questions are technical and are being addressed by the information studies community already (Furner, 2002; Solomon, 2002). Others can be addressed as behavioral or policy questions. When is it effective to segment user needs by institution? Will search engine models that allow users to categorize questions be effective? What if the categorization is source based (e.g., telephone number, restaurant review, medical dictionary, library catalog)? What are other models that might be effective?

## Summary and Conclusions

Libraries are an essential component of a nation's information infrastructure, yet they are rarely mentioned in the public-policy documents that define and frame such infrastructures. They often are invisible to their users and to their stakeholders. The library community is responsible for identifying its goals for local, national, and global information infrastructures and to act upon them. In this paper, I have presented four challenges faced by libraries and have proposed research designs to address each of them. The four challenges involve 1. invisible infrastructure, 2. content and collections, 3. preservation and access, and 4. institutional boundaries. While these were first identified in an earlier publication (Borgman, 2000), here I have expanded and updated them, proposed research designs to explore the challenges, and sought to complement other articles in this special issue.

The challenge involving invisible infrastructure is the broadest of the four, and is a theme that runs through the other three. Libraries risk being victims of their own success, as good design and good service tend to be unobtrusive. The research questions posed for this challenge address how visible libraries are to their users and other stakeholders—but also how well stakeholders' goals are represented in library plans and policies. Visibility cuts both ways.

The second challenge, of content and collections, addresses the problem of defining the concept of a "collection" in an environment where libraries provide access to a wide array of content that they may or may not possess. Research questions in this arena ask users and stakeholders to define what they mean by "collection," and ask about how they use various forms of collections and content. The coherence of collections that include diverse resources and serve diverse audiences is of particular concern.

Preservation and access, the third challenge, is the most expanded from its earlier incarnation. I took that liberty because the challenge for library collections is being addressed in another article in this issue by Deanna B. Marcum, one of the most knowledgeable experts on the topic. Instead, I focus on the stability of access to online resources that are of value to a library's users, but over which the library may have little control. Research

questions in this area address user behavior with regard to persistence; the relationship between persistence, preservation, and access; and knowledge organization methods that might improve persistence.

The fourth challenge, involving institutional boundaries, is also expanded from its original framing, coming full circle to the challenge of invisibility. Not only are the boundaries blurring between three preeminent types of information institutions—libraries, museums, and archives—but the boundaries are blurring between the collections and services provided by these institutions and other entities. Search engines are both a blessing and a curse in this regard. They provide global searching capabilities while stripping those same searches of their context. Research questions in this arena focus on identifying roles of each institution, relationships between them, and ways to aggregate and disaggregate various functions.

The four challenges are intertwined and research on each of them will inform the others. I have proposed a mixture of research methods that includes surveys, case studies, documentary analyses, and policy analyses. Participation in these studies would be sought from users of information services, writers and publishers of content, stakeholders in parent organizations, and policy-makers far removed from libraries. While most of the studies are framed in terms of individual libraries, universities, or geographical regions, the designs are intended to be adaptable to larger and smaller units. I hope the guidance provided will encourage a wide range of information studies scholars and librarians to pursue research in these areas, for it is much needed. Only with a better understanding of these challenges can libraries find their best fit in the information infrastructure of our networked world.

## Acknowledgements

Thanks are due to Mary Jo Lynch of the American Library Association for conceptualizing this special issue and for her comments on earlier drafts; to John Klensin, Chair of the Internet Architecture Board, for comments on an earlier draft and for clarifying aspects of the persistence of URLs; and to David Tyckoson of California State University, Fresno, for comments on the changing scope of library catalogs.

## Notes

1. The ADEPT Web sites at UCLA (http://is.gseis.ucla.edu/adept/) and UCSB (http://www.alexandria.ucsb.edu/adept/) provide links to continuing research reports. The project is funded from 1999 to 2004 by the National Science Foundation's Digital Libraries Initiative (http://www.dli2.nsf.gov), grant no. IIS-9817432.
2. We are currently addressing these issues with geography faculty as part of the ADEPT project. See forthcoming work by Borgman, C. L.; Smart, L. J.; Millwood, K.; and Finley, J.

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# Five Grand Challenges for Library Research

MICHAEL K. BUCKLAND

## ABSTRACT

LIBRARIANS HAVE MANY AND VARIED DIFFICULTIES. For some library problems research is not the best remedy. Improved coordination, clarification of values, or drawing on existing research results may suffice. When research is indicated, it pays to be selective. Investing in research, like any other kind of investment, should be judged in terms of the probability of success, the likely delay before results are achieved, and the impact on the population of competent researchers, as well as the perceived importance of the problem. New technology permits new forms of service, generates new data for analysis, and supports new tools for researchers. Normal research is repetitious and progresses incrementally. A bolder strategy is to seek significant advances in library service by challenging researchers to achieve a deeper understanding of important, but inadequately understood, library phenomena. Five Grand Challenges are proposed: 1. Library service: Could library services be made more meaningful? 2. Library theory: Who knew what when? 3. Library design: Have digital libraries been designed backwards? 4. Library values: How neutral can libraries be? and 5. Library communities: How do communities differ?

## INTRODUCTION

Librarians—especially library administrators with difficult decisions to make—often call for more research, and we would do well to ask them to compile a list of what they most need to know. But, before converting such a list into a research agenda, we need to ask two questions: First, is research really what is most needed? Second, in which areas is research likely to be most productive? More research is often not the best option. Rather, some

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LIBRARY TRENDS, Vol. 51, No. 4, Spring 2003, pp. 675–686

way to reduce uncertainty about what course of action to choose is needed, and not all kinds of uncertainty are helped by research, at least not by academic research. Friend and Jessop (1969) provide a helpful analysis based on their observation of the reconstruction of the city of Coventry after the bombing of the Second World War. They distinguish three different kinds of uncertainty, paraphrased thus:

> *Uncertainty concerning the decisions of others:* As a practical matter, libraries are often interdependent with other agencies. If the city is revising its transportation and traffic plan, choosing a location for a new library building could be done better after the revised transportation plan has been decided. Meanwhile, those responsible for developing the transportation plan, could make a better plan if they knew where the new library was going to be located. The way to resolve such uncertainties is not research but closer coordination. The librarian and the transportation planners should meet and decide jointly, or both decisions should be moved to a higher level in the administrative hierarchy.
>
> *Uncertainty concerning values:* Libraries serve multiple constituencies. A library director faced with a budget decrease can calculate alternative ways to reduce expenses and yet still not know what to do. A university library director could achieve the required economies by reducing science journal subscriptions or humanities book funds or library opening hours, and still be undecided because these cuts would affect different groups differently and so the decision becomes political, a matter of assigning priorities between different groups. It is a matter of clarifying values, rather than conducting research. A wise course of action would be to seek guidance from the Library Committee and the university president.
>
> *Uncertainty concerning the environment:* What would be the likely consequences of alternative decisions? This may require conventional research, such as a survey, a feasibility study, or the development of a new prototype. Yet, very often, unless preciseness is required, it is often sufficient to draw on existing research results by asking an experienced researcher or examining the research literature. And when that is not enough, some simple counting, measuring, or observing may suffice.

So, as far as library administrators are concerned, more research is often not really the best or only way to go. For the individual researcher, undertaking research can require a major commitment of time, attention, and resources, even if someone else is willing to supply funding. There is always an opportunity cost: one could have been researching something else instead. Because research requires a significant investment of time and attention, individual researchers' decisions concerning research resemble decisions concerning the investment of money. A good research project, like a good financial investment, is one that will yield a substantial return, on a small investment, with little risk, and in the short term. As with money, there are usually trade-offs. An assistant professor will find a research project more attractive if results can be expected before, not after, a tenure appraisal.

Funders and managers of research have some additional motivations. They too want an agenda that will provide a good return on their investment, but they also have, or should have, additional goals: to develop and sustain a population of competent researchers, to encourage interactions among them, to keep them intellectually challenged, and to work with them to focus on research agendas deemed important and viable.

For all these reasons, composing a good research agenda involves more than the listing of significant problems and uncertainties. The questions to be researched should be nontrivial, intriguing to whoever is to work on them, and expected to have significant consequences for practical decisions for and/or our understanding of our field. The advent of new technology is especially significant, not only for new ways to provide library services, but also, as a byproduct, for vastly increased data about the resources, the users, and usage—and, as well, more powerful tools for the researchers. The availability of new sources of data and new research tools means that there may now be new ways to address old problems.

We started with the assumption that a research agenda should be based on and driven by specific problems identified by librarians and library administrators. Certainly we should seek to help them in whatever way we can, but that is not the only option. What if we formulated the question differently and thought also in terms of the best possible use of researchers? What strategic investments of research funding could transform our understanding of librarianship and move the whole field to a higher plane? How could we make the next decade as richly formative for library service as the late nineteenth century was? Researchers, being human, respond best to problems that are exciting, worthwhile, and, above all, challenging. They need, and we all need, Grand Challenges. So here are five. Each is a plea for a significant research front to be opened up and explored, rather than for a single researchable question for which there is a known methodology.

## Library Service: Could Library Services Be Made More Meaningful?

Everyone should want libraries to have a large and positive impact on the communities they serve. We should all want the benefits resulting from investment in library services to be high, and to be seen to be high. Richard Orr (1973) wrote a classic analysis of the notion of "library goodness" and there is an established tradition of research on output measures and cost-effectiveness (e.g., Baker & Lancaster, 1991), including quite sophisticated analyses of how different communities might have differing preferences (e.g., McDonald & Micikas, 1994; Talja 2001). These studies are mainly of aggregate usage and the impact assessments tend to be indirect (e.g., measures of library use) or narrowly instrumental: After using library materials, John passed an examination, and Jane was able to build a wall by herself, with imputable economic benefits for each. Yet, the primary impact of

library materials is through the meanings they have for our minds. They influence our knowledge, our beliefs, and our attitudes. How could we understand better how *meaningful* library services are for the individual?

Children's librarians are interested in how appropriate books are for children of different ages and backgrounds. Bibliotherapists recognize the therapeutic potential of reading books and, decades ago, the library literature contained discussion of the effects of reading (e.g., Waples, Berelson, & Bradshaw, 1940). More recently there has been heightened sensitivity to the probable reactions to library materials by different cultural groups, and the word "relevant" has been widely used in relation to library materials, library services, and retrieval performance. We all want collections, services, and retrieval results to be "relevant," a term that has remained problematic. Wilson's classic discussion of relevance concludes that it would be simpler to replace use of the word "relevance" by separate words for the three different meanings that he discusses: logical relevance, a suitable documentary means to ends, and satisfactoriness (Wilson, 1968, chapter 4). Only the last two matter for library purposes.

The process of learning is essentially and necessarily subjective and it is, therefore, to a greater or lesser extent emotional. We may react with shock, horror, joy, or suspicion to some claim, statement, or evidence. When we say of some experience that it was "meaningful" for us, we usually imply an emotional or aesthetic response as much as a rational one. The technical term for this emotional reaction is "affect." We also tend to accept what we want to experience and to avoid or doubt what is unpalatable. Reading a book, viewing a film, or making a discovery can be a "moving" experience. A significant new insight is called an "epiphany." That learning is profounder when we are emotionally engaged is generally accepted. Since this is the case, what can we do to recognize, acknowledge, and incorporate affect into library service?

Discussion of what books are "relevant" tends to reduce rather quickly to what they are about, on the assumption that if a document is about the same topic as an enquiry, the document is "relevant" and there has been a satisfactory outcome. (Reliance on machines and formal systems and the need to be efficient are liable to reduce this process to looking for occurrences of matching strings of characters.) Librarians know, however, that what a book is about is often a matter of perspective and that meaningful learning (as opposed to rote memorization) depends on whether the readers can relate what is read to what they already know.

What a book is about tends to viewed in literal and limited terms. At a literal level, Aesop's fables are about animals: the fox, the stork, frogs, and other creatures. But we read the fables because they are allegorical. They are really about the foibles of human beings, not zoology, and can be enjoyed at that level. And, the purpose of each fable is at a third, higher, level of interpretation: to teach a moral lesson. Each fable is a brief lesson about

morality. Taken as a group, one could consider them inspirational: they are intended induce in us a more ethical attitude. Already in the European Middle Ages, these multiple levels of meaning in text were recognized. If meaning matters and if it is at multiple levels, how can modern library services catch up with the European Middle Ages? A related issue is the very large difference between what an image depicts (a dove, maybe) and what a picture is about (peace, perhaps). Mechanized content analysis is not likely to rise above the literal level and present subject cataloging practice seems to slip very quickly from topical headings to genre headings.

People use libraries, so how could we achieve a deeper understanding of what makes the use of library services personally meaningful?

## Library Theory: Who Knew What When?

Library history is a well-developed field. Its strengths have been in the histories of libraries as institutions and the biographies of librarians, both very worthwhile undertakings. What is less well-developed is the intellectual history of the field. (The *Dictionary of American Library History* [Wiegand, 1994] reflects this situation.) What ideas influenced which librarians? Where did the ideas come from? How and when were ideas adopted and adapted? How did ideas spread to other fields outside of librarianship? (A fine example of intellectual history is Johnson's *The Austrian Mind,* 1972). There are multiple reasons to do this kind of work, in addition to its intrinsic interest. We understand objects, individuals, and institutions better if we know about their past experiences, and we understand ideas and theories better if we know how they developed and what has already been said and done with them. Fortunately, in recent years there has been an increased interest in this kind of historical work in library and information science. We note the work of the Special Interest Group on the History and Foundations of Information Science in the American Society for Information Science and Technology (Hahn & Buckland, 1998; Bowden, Hahn, & Williams, 1999), the Conception of Library and Information Science conferences (esp. Conceptions, 1992), and a few, rather isolated scholars (e.g., Casey, 1981; Day, 2001; Rayward, 1994). More such research and more of a focus on the development of librarianship would be welcome. We need critical and historical analyses of our theories and assumptions.

Asking "Who knew what when?" opens up a major research front. A narrower, but rather central question, is "What has been the influence of technological modernism?" By technological modernism we mean the impact of positivism, scientific management, efficiency, and algorithms. Technology, standards, systems, and efficiency lead to engines for social progress. Melvil Dewey was famous for his interest in efficiency. Librarianship used to be called "Library Economy." The technological imperative to use equipment (cards, punch cards, digital computers) imposes requirements for standardization. The "information science" end of library and

information science has been largely about trying to base library service on algorithms. The premise behind this question is that what we call technological modernism was a dominant influence in Western society from the late nineteenth century to the present and that the influence on and in librarianship has been greatly underestimated.

Another intriguing line of inquiry is how we have come to understand our history and, thereby, ourselves. In the literatures on digital libraries and information retrieval, the iconic status of Vannevar Bush and his essay "As We May Think" is doubly interesting as a case study: first as a cult phenomena in its own right, examined by Smith (1981, 1991); and secondly in showing how a lack of historical awareness results in an uncritical, mythic tradition, and the erasure of history (Buckland, 1992).

The study of who knew what when has the additional benefit of drawing attention to the interactions within librarianship and with other fields and, in addition, giving us a fuller, richer sense of identity.

## Library Design: Have Digital Libraries Been Designed Backwards?

An enormous investment continues to be made in "digital libraries" and in the automation of library files, library processes, and library services, and rightly so. But, perhaps inevitably, the program has been data-centric, focusing on how to create a database and how to enable individuals to search a database; then to do the same with another dataset. It has been a natural, sensible, and, perhaps, inevitable way to proceed from an engineering point of view. Yet, it is backwards because library services should be user-centered rather than data-centered. Digital libraries have, in effect, adopted the approach of a publisher—producing one book after another—rather than of a librarian whose task it is to form a coherent collection of resources for library users. One could say that this phenomenon reflects the difference between use of a single reference *work* and using a reference *collection.*

As one example, many inquiries relate to places. Users want to know about hiking in the Himalayas, the castles of Quercy, the birds of the Pacific northwest, and so on. Effective searching by place is a function that librarians do need to provide. In practice, library catalogs depend on place-names, primarily for geopolitical entities. Place-names are ambiguous, unstable, and exist in variant forms. Geopolitical entities are also unstable since boundaries and political structures both change. Searches involving regions that are areas other than geopolitical entities can be difficult. Yet places, unlike topics, persons, institutions, and events, have a system for objective specification: latitude and longitude. Further, there is a well-established tool for linking *place-names* with *places:* the gazetteer, most familiar as a list of place-names printed in the back of atlases, serving as an index to the maps. Coupling online gazetteers with online catalogs would not only provide place-name disambiguation, but also the data needed for vi-

sualizing queries and retrievals in map form, and the ability to extend searches to nearby places (Buckland, Gey, & Larson, 2002). When we then consider linking both catalogs and gazetteers to encyclopedias, bibliographies, biographical dictionaries, socioeconomic numeric data series, and more, a really exciting vision of library service emerges. For users to be able to search eclectically among many different and differing digital sources, as one could do in an old-fashioned reference library, would transform their ability to find out about a topic, an event, or an idea. Digital library development has simply not provided for this kind of service, not yet. A broad research agenda at two levels is needed:

1. At a detailed level, a patient working out of the practical details of linking specific pairs of resources or genres is necessary. As one example, linking bibliographic databases with socioeconomic data series is difficult because the data series commonly have a geographic aspect and merely using place-names is quite unsatisfactory in practice. Georeferencing, using spatial relationships defined by latitude and longitude, and maps for display, is much more effective.
2. At a broader level, better tools are needed for navigating multiple metadata, building crosswalks between different vocabularies, and integrating search results into personal computing environments.

These problems are not new, but solving them has become more pressing. Only when substantially more research and development has been completed from the library user's perspective can the digital library environment begin to have the look and feel of good library service.

## Library Values: How Neutral Can Libraries Be?

There is a deeply established belief in the United States that libraries, especially university libraries and public libraries are, or should be, politically and socially neutral. But, how far *can* libraries be neutral? It cannot be claimed convincingly that all libraries are neutral. Library services are always funded for a purpose, and to say that they are purposive means that they exist to advance certain values. In principle, the selected purpose could be to be neutral. What would that mean in practice? How feasible, realistic, and verifiable would that be? There are contradictory indications.

Two factors argue for neutrality. First, libraries appear to be inherently pluralistic, in theory and in practice, even if only because bibliographies, citations, and reference works generally, tend to lead to other works. However narrowly focused collection development in a particular library may have been intended to be, if trails are followed they will lead to many destinations. In that way, libraries seem inherently subversive of imposed control. Second, many librarians, their governing boards, and their professional associations, have a commitment to open inquiry, freedom to read, and

"balanced" collections. In Britain it used to be said that the creed of the librarian was "no politics, no religion, no morals" (Foskett, 1962).

There are, however, several reasons to question not only how neutral libraries actually are, but also how far they could be. First, there is the source of funding. Even in the public sector, libraries are guided by the purposes of their funding bodies. Public funding is political funding. The funding bodies have agendas and are unlikely to be indifferent to the use and impact of the funding that they provide. They may have specific agendas, such as supporting the local economy, nurturing local history, or increasing adult literacy. Even if there is a generally liberal attitude there will be limits to what will be socially and, therefore, politically acceptable in the use of library funds. Second, librarians' commitment to neutrality tends not to be absolute. A major study of censorship in public and school libraries in California found widespread self-censorship by the librarians seeking to avoid censorship being imposed from outside (Lowenthal, 1959). Third, both libraries and librarians unavoidably operate in cultural contexts that tend to impose limits on what is acceptable. The politics of identity, for example, and current concerns for security are powerful forces.

These issues have been discussed many times before, primarily from a principled, ideological perspective. What is suggested here is empirical investigation of how, and how far, inquiries are, or could be, diverted to, or away from, particular sources or bodies of knowledge. Our mission is to provide access to resources. How well do we understand the factors and mechanisms by which inquiries are steered toward or away from some sources? How, and in what ways, can librarians exercise effective influence, given the powerful roles of publishers? New developments include the continued concentration of media publishing into fewer companies, the extreme fragmentation of special-interest publishing, and the difficulties both in principle and in practice of controlling or guiding library access to Internet resources. Regardless of how neutral we may wish library services to be, we should seek to understand how far, and how best, degrees of neutrality in access to recorded knowledge are achieved. Thorough analysis of these issues is desirable on both theoretical and practical grounds. It would provide a better understanding of how library services are situated in this regard and of what the options are. Analysis of these issues of neutrality would provide us all with deeper insights into library service.

## Library Communities: How Do Communities Differ?

There is a long-established tradition of library research on the communities being served, especially of demographic factors associated with library use or nonuse. In several other fields there has been increased interest in the study of communities. Examples include the mapping of social networks, analysis of ethnic diasporas, and the formation of virtual communities over the Internet. It would be interesting to see whether the analysis of

library-related communities could now be advanced by drawing on these newer forms of community analysis and also by incorporating some related library phenomena.

Libraries are, for example, engaged with communities in two different senses. First, they cater to their communities of readers. Second, as purchasers, libraries participate in the communities of writers, publishers, and readers that create specialist literatures. Scholarly literature, for example, is generated within scholarly specialties. Each such community has its own interests, methods, and terminology, and libraries selectively acquire, or provide access to, the published discourse of these specialties. Individual library users participate in these communities in both senses. They are, by definition, in the communities served by libraries, but also, by reading and thereby justifying the purchase of publications, they participate in the communities of discourse. In universities, the writers, editors, referees, and readers of the publishing community are also part of the community of library users.

Scholarly communities of discourse have been analyzed with great sophistication by means of citation analysis. When libraries provide access to library materials, they are necessarily providing access to the literature of different communities, treating "literature" very loosely to cover any genre. But, there is little acknowledgment that libraries are providing materials by and for multiple small communities. Since the formation of vocabulary evolves within communities, within domains of discourse, it would be logical and user-friendly to create separate catalogs and indexes for each specialist community, using the distinctive terminology of that specialty. Catalogs, however, have always been one single, procrustean index created for and from the entire collection. Bibliographies, like catalogs, cover an arbitrary range of more or less related specialties, with one unified index for all to share. In a predigital environment nothing else was feasible, but digital technology opens new options. Initial experiments indicate that creating multiple indexes to the same database, each prepared for a different community of users, would support significantly more successful searching, but only if users are matched to the right specialized index (Buckland, Jiang, Kim, & Petras, 2001). The conclusion that performance is best within specific domains and deteriorates as the coverage of the system expands to include additional domains is consistent with experience in artificial intelligence and machine translation.

Bibliometric analyses offer another basis for the comparative analysis of communities. Literatures are more or less obsolescent in the sense that older documents tend to be used less than more recent ones are, and the rate of obsolescence is faster in some fields, notably physics, than in others, such as history. Literatures are also more or less dispersed. Articles may be more or less heavily concentrated, with many articles in a few leading journals, others in a larger number of journals, and the remainder scattered

over very many journal titles. The dispersion of articles on a topic across journal titles is irregular and this pattern is commonly known as Bradford's Law of Scattering. There have been disagreements over the best mathematical formulations, but these two bibliometric patterns are generally accepted. Unanswered questions are whether these two basic structural patterns are related to each other, as they seem to be, and, if so, what other systematic variations are there between specialist literatures (Buckland, 1972)? One approach is to view obsolescence and scattering as surface phenomena reflecting differences in the nature of the discourse in different communities. How much do literatures differ on these dimensions? How stable are they? What causes the differences? Are there comparable analogous differences in patterns of Internet usage?

As the technologies of publication change, the viability of highly specialized literatures can be expected to increase. One thinks of narrowly focused e-zines, Web sites, and e-journals, as well as specialized conventional publications. How and why do specialties arise, expand, and wither? What kinds of responses are then required in access and in bibliographic control to adapt to a changed situation? The definition of "community" is itself problematic. There are communities within communities and we are all members of multiple communities simultaneously. How are communities to be identified and their boundaries detected?

These examples support the argument that there should be more investment in the analysis of communities, especially comparative analysis. This reinforces the cogent arguments of Hjørland (2002) for domain-based approaches to library and information studies. The dramatic increases in available digital bibliographical data and in computing power mean that domain-based research has become more feasible.

## Conclusion

Librarians face many difficult decisions and uncertainties and, for some of these, focused research projects can and should be undertaken. These studies will, cumulatively, edge us forward. But significant advances in library service are likely to depend on substantial advances in how we understand the phenomena involved. If we want research to transform our understanding of librarianship, if we want to discover how to provide more sophisticated library services, if something more than the minor incremental advances of normal research is wanted, then we need a different, bolder strategy. Areas within our interests that are important, but inadequately understood, need to be identified and researchers should be challenged to provide new insights using whatever techniques they can.

## Acknowledgments

I am grateful for the helpful comments of Vivien Petras and Patrick Wilson.

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